

PACIFIC ISLANDS FISHERIES SCIENCE CENTER



Economic and Social Characteristics of Guam's Small Boat Fisheries

Justin Hospital
Courtney Beavers

December 2012



Administrative Report H-12-06

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For further information direct inquiries to

Chief, Scientific Information Services
Pacific Islands Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
2570 Dole Street
Honolulu, Hawaii 96822-2396

Phone: 808-983-5386
Fax: 808-983-2902

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Economic and Social Characteristics of
Guam's Small Boat Fisheries

Justin Hospital
Pacific Islands Fisheries Science Center
National Marine Fisheries Service
Socioeconomics and Planning Group
1601 Kapiolani Boulevard, Suite 1000
Honolulu, Hawaii 96814

Courtney Beavers
Joint Institute for Marine and Atmospheric Research
University of Hawaii
Socioeconomics and Planning Group
1000 Pope Road, Honolulu, Hawaii 96822

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EXECUTIVE SUMMARY

This report presents an empirical snapshot of boat fishing on the island of Guam using results from a cost-earnings survey of the fleet conducted in 2011. Survey booklets were completed by 147 fishermen. This paper profiles the current Guam boat-based fleet and details current levels of fishing activity, behavioral aspects of fishing, market participation, average trip costs, fishing-related expenditures, levels of investment, the social and cultural importance of fishing, as well as attitudes and perceptions of fishing conditions and management.

The demographics of the Guam fleet reveal the rich tradition and cultural importance of fishing to the people of Guam. On average, fishermen responding to the survey were 44 years old and reported to have been boat fishing for an average of 20 years. Guam small boat participants were most likely to identify themselves as Chamorro and reported similar nativity rates relative to the general population of the island of Guam. In general, fishermen were also more educated and more affluent than the general population.

The typical fishing vessel on Guam is approximately 21 feet long with 168 horsepower, was built in the early 1990s and purchased in the early 2000s. Nearly 86% of vessels were reported to be less than 25 feet in length. There was considerable evidence of co-ownership and sharing of fishing vessels as, on average, nearly 45% of vessel owners reported that their vessel is used, at least part of the time, without the boat owner on board. On average, fishermen reported 3 people on board while fishing. About one third (38%) of the fleet reported to be a 2-person operation with a captain and one crew member, while another third (32%) typically fish with one captain and two crew members. A mere 7% of fishermen reported to always fish alone.

Guam fishermen, on average, reported approximately 39 boat fishing trips in the past 12 months, with fishermen who sold fish reporting more fishing trips relative to those who do not sell fish. Boat fishermen on Guam use many gear types and target many species throughout the year. On average, fishermen reported the use of 3 different gear types/target species during the past 12 months, with pelagic trolling as the most popular gear type followed by shallow-water bottomfish fishing and deepwater bottomfish fishing. Members of the Guam Fishermen's Cooperative Association (GFCA) reported higher levels of pelagic fishing relative to nonmembers. Survey respondents indicated that their fishing trips in the past 12 months were nearly evenly distributed across local (< 3 nm) and federal waters (3-200 nm). The importance of Fish Aggregating Devices (FADs) was evident as 96% of fishermen reported to have fished at a FAD during the past 12 months, and on nearly half (53%) of their fishing trips. A high degree of seasonal fishing effort was found for bottomfish and reef fish fishing activity across all subgroups of the fleet.

A majority of fishermen (70%) reported to sell at least a portion of fish caught in the past 12 months and, on average, these fishermen reported to sell fish after approximately 59% of their fishing trips in the past 12 months. On average, fishermen reported to sell

approximately 24% of their total catch. For the majority of the fleet there is considerable heterogeneity in levels of market participation, utilization and access, although the majority consider the fish they sell to contribute *very little* to their personal income, as cost recovery is a major motivation for selling a portion of catch. There do not appear to be significant market limitations for Guam fishermen as 82% of survey respondents feel that they can always sell all the fish that they want to sell, no matter the species, and we found little difference between GFCA members and nonmembers.

During 2010 and 2011, the cost of a trolling trip averaged approximately \$235 with a median cost of \$190. As anticipated, fuel expenses accounted for a majority (72%) of total pelagic trip expenditures. Likewise, the average bottomfish trip cost was reported at \$197 with a median of \$170. Fishermen reported an average reef fish trip to cost approximately \$116 (median of \$85). We found fuel to account for a similar share of the cost structure for bottomfish and reef fish fishing, though reef fish fishing is less fuel-intensive. In total, it is estimated that Guam small boat fishermen responding to our survey provided direct trip-related sales impacts ranging from approximately \$0.98 million (using median trip costs) to \$1.23 million (using mean trip costs) to the island economy.

In addition to variable trip costs, fishing requires significant annual fixed-cost expenditures. Nearly every survey respondent (94%) reported to incur at least some non-trip-related fishing expenditures during 2010. The most common expenditure categories were fishing gear (88%), oil and lube (84%), repair and maintenance (81%), fees (77%), and safety equipment (66%). As one would expect, the median annual fishing related expenditures in 2010 was significantly higher for boat owners (\$4270) relative to non-boat owners (\$600). In aggregate Guam small boat fishermen responding to our survey incurred total annual fishing expenditures of approximately \$0.88 million. In considering the direct economic impact to the local island economy, fishermen reported, on average, that 49% of fishing expenditures were purchased directly on island. Therefore, direct sales impacts of fishermen responding to the survey from non-trip related expenditures equate to approximately \$0.43 million.

The breakdown of catch disposition in the Guam small boat fishery reflects the social and cultural motivations towards fishing and sheds light on the complexities of classifying catch in the fishery. Fishermen who responded to our survey reported that approximately 29% of fish catch was consumed at home, while 42% was given away, with approximately 24% of fish sold. The remaining catch is either released (2%) or exchanged for goods and services (3%). This diversity of catch disposition even extends to avid fishermen who regularly sell fish as they still retain approximately 30% of their catch for home consumption and participation in traditional fish-sharing networks and customary exchange. Additionally, fish are clearly an important source of food for fishing families: 78% consider the pelagic fish they catch to be an important source of food, 79% for bottomfish, and 85% for reef fish. These findings validate the importance of fishing in terms of building and maintaining social and community networks, perpetuating fishing traditions, and providing fish to local communities as a source of food security.

In this report we present attitudes and perceptions towards recent fishing conditions, expectations for future fishing participation, effects from the establishment of the Marianas Trench National Marine Monument, attitudes towards marine preserve areas (MPAs), and impacts of military exercises in the region. The survey questionnaire also provided fishermen the opportunity to expand on their responses to these questions by including open-ended comment sections. Additionally, the final page of the survey questionnaire was left blank asking for “suggestions for future management or topics needing further study.” Many fishermen took these opportunities to provide direct feedback to managing agencies. A report of raw survey comments loosely organized by topic can be found in Appendix B to this report.

We find the Guam small boat fishery to be a complex mix of subsistence, cultural, recreational, and quasi-commercial fishermen whose fishing behaviors provide evidence of the importance of fishing to the island of Guam. This report provides important baseline information that can be used to inform future management alternatives and actions.

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CONTENTS

Executive Summary	iii
Introduction	1
Survey Methods	2
Response Rates	3
Results	3
DEMOGRAPHICS	4
VESSEL CHARACTERISTICS	11
FISHING ACTIVITY	13
MARKET PARTICIPATION AND ACCESS	23
TRIP COSTS	31
ANNUAL FISHING EXPENDITURES	36
LEVELS OF INVESTMENT	40
CREW CONSIDERATIONS	42
SOCIAL ASPECTS OF FISHING	42
Catch Disposition	42
Social Networks	43
Social Standing	44
Food Security	45
Fisher Classification	46
FISHER PERCEPTIONS	48
Fishing Conditions and Participation	48
Marianas Marine National Monument and Closed Areas (MPAs)	50
Military Impacts	53
COMMENTS FROM FISHERMEN	54
Conclusion	55
Acknowledgments	55
References	57
Appendix A. Survey Instrument	A-1
Appendix B. Comments from Fishermen	B-1

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INTRODUCTION

The island of Guam, a U.S. territory, is located in the western Pacific Ocean at 13°28' N, 144°45' E and is the southernmost island in the Mariana Archipelago (Fig. 1). It is the largest island in Micronesia, with a land mass of 560 km², and has a total shoreline length of 244 km (Burdick et al., 2008). A variety of reef types are represented on Guam, including fringing reefs, patch reefs, submerged reefs, offshore banks, and barrier reefs. Fringing reefs are the predominant reef type, extending around much of the island (Burdick et al., 2008). The combined area of coral reef and lagoon is approximately 108 km² in nearshore waters with depths between 0 and 5.5 m (0 and 3 nm shoreline radius), and an additional 110 km² in federal waters greater than 3 nm offshore (Hunter, 1995; Burdick, 2006).

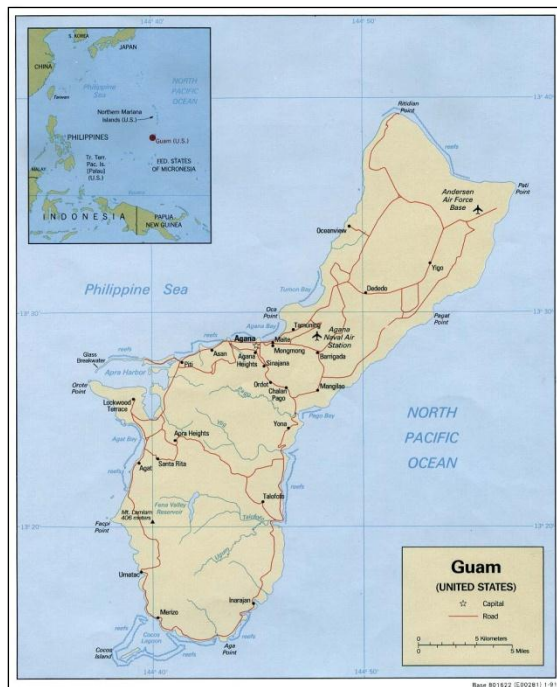


Figure 1. The island of Guam.

Source: The University of Texas Library

(http://www.lib.utexas.edu/maps/australia/guam_pol91.jpg)

The original Chamoru (or Chamorro) inhabitants, arriving at least 3500 years ago, were expert fishermen and seafarers (Amesbury and Hunter-Anderson, 2003; Amesbury, 2006). Accounts by the early Spanish visitors indicate that they fished on the high seas in large sailing canoes (*proas*) and used numerous methods to catch reef and bottomfish from boats (Amesbury et al., 1989). Throughout the Spanish period (1668-1898) the Chamorus were persecuted and attempts were made to confine them to the

island of Guam. By the beginning of the American period in 1898, the indigenous inhabitants had lost many of their seafaring and fishing skills as well as the native names of many of the offshore species (Myers, 1993).

Over time, Guam fishermen reestablished their connection with offshore waters, and institutions such as the Guam Fishermen's Cooperative Association (GFCA) provided marketing opportunities to support the expansion of the small boat fleet fishing for pleasure and subsistence, and to support market demand for local fish. Fishing on Guam continues to be important not only in terms of contributing to the subsistence needs of the indigenous Chamorro population but also in preserving their history and identity with a strong connection to the sea and its resources (Allen and Bartram, 2008). Unlike many areas in the United States, the concept of fishing for sport is relatively new, and the use of "recreational" boating and fishing equipment and techniques for subsistence and commercial purposes is well established (Myers, 1993).

This report presents an empirical snapshot of small boat fishing on the island of Guam using results from a cost-earnings study of the fleet conducted in 2011. This paper profiles the current Guam small boat fleet and details current levels of fishing activity, behavioral aspects of fishing, market participation, average trip costs, fishing-related expenditures, levels of investment, the social and cultural importance of fishing, as well as attitudes and perceptions of fishing conditions and management. This report serves as an important update to the last comprehensive report on small boat fishing in Guam (Kasaoka, 1989), as recent research has focused on subgroups of the fleet including pelagic fishing (Rubinstein, 2001) and reef fishing (van Beurking et al., 2007). The findings from this research provide fishery managers with insights into the economic and social context of the fishery and could help guide the design and analysis of future management actions and alternatives.

SURVEY METHODS

In January 2011, this research project was introduced to the community at two fisheries management meetings with representation from members of the fishing community: the Mariana Archipelago Ecosystem Plan Team and Marianas Advisory Panel. These presentations detailed the contents of the survey and demonstrated how the information collection can be used in management of Guam's fisheries. In the months after these meetings, a survey booklet was developed by staff at the Pacific Islands Fisheries Science Center (PIFSC) in consultation with local stakeholders, fishermen, and fishery managers. The Pacific Islands Fisheries Group (PIFG)¹ was contracted to administer the survey

¹ The Pacific Islands Fisheries Group (PIFG) is a Hawaii-based 501(c)3 nonprofit organization established in 2005 to organize and keep Pacific Island fishermen informed about current fishery issues. The PIFG supports programs that benefit Hawaii's marine resources, enhances the fishing community's awareness about current fishery issues and fosters responsible fishing and conservation practices. PIFG supports agencies responsible for monitoring, managing and conserving our island's resources. (source: <http://www.fishtoday.org/about-pifg>)

instrument. The majority of surveys were completed in-person by fishermen at 3 community meetings held throughout 2011 (May, August, and December). All of these meetings were held at the centrally located Guam Fishermen's Cooperative Association (GFCA) in Hagatna. Additionally, surveys were completed by fishermen who volunteered to participate but were unable to attend the community meetings. PIFG staff facilitated the distribution and collection of these surveys to these fishermen. Anyone who had fished from a boat in the past 12 months was eligible and encouraged to participate in this research. Contact information for all survey respondents was collected for data quality assurance, although this information is kept strictly confidential and no individual-level responses are reported here in this report.

RESPONSE RATES

A total of 147 surveys were completed in 2011 and the distribution of completed surveys from attendees at the multiple community meetings and voluntary participants are shown in Table 1. While nearly all fishermen who attended the community meetings completed a survey, it is somewhat difficult to estimate the coverage of our survey sample as there are no definitive measures of small boat fishing participation on Guam. Participation estimates based on an established creel survey program administered by the Guam Division of Aquatic and Wildlife Resources (DAWR) indicate an average of 454 active fishing vessels on Guam during 2010-2011, with a 95% confidence interval ranging anywhere between 393 and 560 (WPacFIN, 2012). Therefore, our sample could range from approximately 27% to 37% of active vessels. Based on the feedback from knowledgeable members of the local fishing community, we received assurances and support that our sample is representative of the active members of the Guam fishing community.

Table 1.--Survey population and response rates, by mode of administration.

Mode of Administration (Month)	Completed Surveys	Share of Full Sample (%)
Community Meeting (May)	58	39
Community Meeting (August)	39	27
Community Meeting (December)	14	10
Volunteer Participants	36	24
Totals	147	100

RESULTS

In this report, survey responses are presented for our complete survey respondent pool as well as for relevant subgroups of the fleet. Most tables provide distinctions between Guam Fishermen's Cooperative Association (GFCA) members² and nonmembers. We

² The GFCA is a prolific organization on the island, founded in 1976. The GFCA purchases all of the fish caught by its members, as long as the catch meets established standards for quality and safety (Allen and Bartram, 2008). In addition to marketing services, the GFCA provides subsidized fuel and ice for its

also analyze results between fishermen who reported the sale of fish in the past 12 months and those reporting no sales of fish³. Additionally, responses are further disaggregated to consider fishery highliners, which for the purpose of this report are defined as those reporting the catch of more than 500 pounds of pelagic or bottomfish and/or more than 250 pounds of reef fish in the past 12 months⁴ and who reported the sale of more than 50% of their catch in the past 12 months. We explore primary species targeting (pelagics, bottomfish, reef fish, and no primary target) based on reported levels of gear usage as a share of total fishing trips in the past 12 months. In some instances, distinctions will be made between boat owners and “crew” fishermen who do not own the vessel on which they fish.

Demographics

This section presents a demographic profile of the Guam small boat fleet. It is important to understand the socioeconomic composition of fishery participants to better understand the potential for differential economic and social impacts from regulatory measures. The majority (66%) of survey respondents were between the ages of 35 and 54 years. This age distribution is understandable given the capital requirements of owning and operating a fishing vessel in addition to the localized knowledge and experience required for successful fishing. Not surprisingly, fishery highliners, on average, are slightly younger than the rest of the fleet, likely associated with the physical requirements of avid fishing. The age distribution for subgroups of our survey respondents is presented in Table 2.

The majority of fishermen (56%) responding to our survey reported to have lived their entire life in the Marianas, whereas the 2010 Guam Census reports that 53% of the Guam population were originally born in the Marianas (US Census Bureau, 2012). This would suggest that the fishing community closely mirrors nativity rates for the general population of Guam.

members, and also extends benefits through fisheries conservation efforts and marine education to the greater Guam community.

³ The distinction between commercial and noncommercial fishing in the western Pacific is complex and is discussed in greater detail in the “Social Aspects of Fishing” section of this report.

⁴ These quantities correspond to the highest catch category option available in the survey instrument.

Table 2.--Survey Responses: “What is your age?”

Percentage of Responses [n]	Less than 25 years (%)	25 - 34 years (%)	35 - 44 years (%)	45 - 54 years (%)	55 - 64 years (%)	More than 65 years (%)
Full Sample [145]	4.1	14.5	32.4	33.8	11.7	3.5
<i>GFCMA Membership</i>						
Yes [77]	2.6	14.3	23.4	36.4	18.1	5.2
No [68]	5.8	14.7	42.7	30.9	4.4	1.5
<i>Sell Fish</i>						
Yes [100]	3.0	13.0	34.0	32.0	13.0	5.0
Highliner [15]	0.0	20.0	46.7	26.7	6.6	0.0
Not Highliner [85]	3.5	11.8	31.8	32.9	14.1	5.9
No [45]	6.7	17.7	28.9	37.8	8.9	0.0
<i>Primary Target</i>						
Pelagics [91]	3.3	13.2	33.0	34.0	14.3	2.2
Bottomfish [19]	5.3	5.3	26.3	47.3	10.5	5.3
Reef Fish [12]	8.4	33.3	33.3	25.0	0.0	0.0
No primary [23]	4.3	17.4	34.8	26.1	8.7	8.7
<i>Boat Ownership</i>						
Yes [100]	1.0	11.0	30.0	38.0	16.0	4.0
No [45]	11.1	22.2	37.7	24.4	2.2	2.2

Table 3.--Survey Responses: “How long have you lived in the Marianas?”

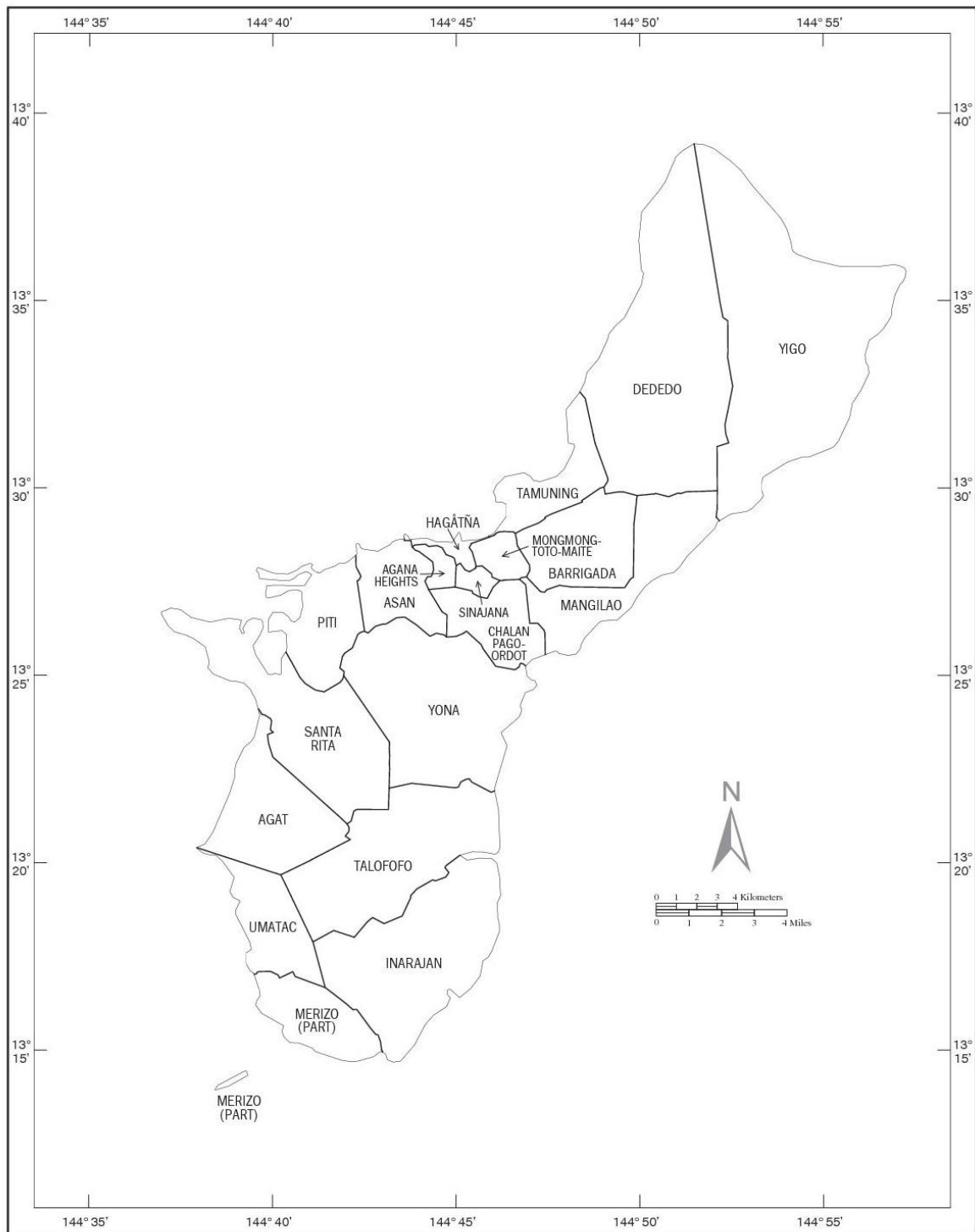
Percentage of Responses [n]	Less than 5 years (%)	5 - 10 years (%)	11 - 20 years (%)	21 - 30 years (%)	More than 30 years (%)	Entire Life (%)
Full Sample [143]	4.9	2.1	11.9	17.5	63.6	55.9
<i>GFCMA Membership</i>						
Yes [76]	1.3	2.6	13.2	17.1	65.8	54.6
No [67]	9.0	1.5	10.5	17.9	61.1	57.4
<i>Sell Fish</i>						
Yes [99]	2.0	2.0	11.1	16.2	68.7	62.0
Highliner [15]	0.0	0.0	6.7	6.7	86.7	60.0
Not highliner [84]	2.4	2.4	11.9	17.8	65.5	62.4
No [44]	11.4	2.3	13.6	20.5	52.2	42.2
<i>Primary Target</i>						
Pelagics [91]	4.4	3.3	9.9	17.6	64.8	54.9
Bottomfish [18]	5.5	0.0	16.7	11.1	66.7	52.6
Reef fish [11]	18.2	0.0	9.1	9.1	63.6	50.0
No primary [23]	0.0	0.0	17.4	26.1	56.5	65.2
<i>Boat Ownership</i>						
Yes [100]	4.0	2.0	11.0	14.0	69.0	53.0
No [43]	7.0	2.3	13.9	25.6	51.2	62.2

Fishermen responding to the survey reported to have been fishing from a boat for an average of 20 years, providing evidence of a rich tradition of fishing on Guam. Fishermen reporting sales of fish in the past 12 months and boat owners have been boat fishing for an average of approximately 22 and 23 years, respectively, as compared to fishermen who do not sell fish and “crew” fishermen (18 years and 15 years). The distribution of boat fishing experience for subgroups of the fleet is presented in Table 4.

Table 4.--Survey Responses: “How many years have you fished from a boat?”

Percentage of Responses [n]	Less than 5 years (%)	5 - 10 years (%)	11 - 20 years (%)	21 - 30 years (%)	More than 30 years (%)
Full Sample [142]	4.2	8.5	16.2	14.1	16.2
<i>GFCA Membership</i>					
Yes [76]	5.3	13.1	27.6	30.3	23.7
No [66]	16.7	24.2	33.3	10.6	15.2
<i>Sell Fish</i>					
Yes [98]	8.2	15.3	30.6	25.5	20.4
Highliner [15]	13.3	6.7	20.0	46.7	13.3
Not highliner [83]	7.2	16.9	32.5	21.7	21.7
No [44]	15.8	25.0	29.6	11.4	18.2
<i>Primary Target</i>					
Pelagics [89]	11.2	12.4	31.5	22.5	22.5
Bottomfish [19]	5.3	21.1	31.6	26.3	15.7
Reef fish [11]	18.2	45.5	18.2	9.1	9.1
No primary [23]	8.7	26.1	30.4	17.4	17.4
<i>Boat Ownership</i>					
Yes [100]	8.0	15.0	28.0	25.0	24.0
No [42]	16.7	26.2	35.7	11.9	9.5

The 2010 Guam Census, administered by the U.S. Census Bureau (U.S. Census Bureau, 2012), reports an estimated population of 159,358 for the island of Guam, up approximately 2% from 2000 Census estimates. Fishermen from villages across the island of Guam (see Fig. 2) completed surveys, and our survey sample reflects the sociocultural and geographic distribution of the general population on Guam (see Table 5). Compared to the island population, the survey sample is slightly underrepresentative of the villages of Dededo and Tamuning, and our survey sample is slightly overrepresentative of the villages of Sinajara and Talofofo. In considering previous work on the Guam fishing community (Vaughn et al., 2000) we find our sample to be similarly distributed, with slightly less representation from Merizo but more from Santa Rita and Yona. While Merizo village has an active fishing community, the 2010 Guam Census reports a 15% decline in population from the 2000 Census. In general the 2010 Census has detailed a marked migration of the Guam population away from the south region (- 12%) and towards the north (+ 6%) and central regions (+ 7%).



U.S. DEPARTMENT OF COMMERCE Economics and Statistics Administration U.S. Census Bureau

Figure 2.--Guam Village Map.

Table 5.--Survey Responses: "What village do you live in?"

Region	Village	Number of Fishermen ^a	Percent of Sample (%)	Vaughn, et al. (2000) (%)	2010 Guam Census ^b (%)	% change 2010 vs. 2000 Census ^c
CENTRAL	Agana Heights	3	2	3	2	-3
SOUTH	Agat	6	4	4	3	-13
CENTRAL	Asan	3	2	1	1	2
CENTRAL	Barrigada	8	6	6	6	3
CENTRAL	Chalan Pago-Ordot	10	7	3	4	15
NORTH	Dededo	26	18	19	28	5
CENTRAL	Hagatna	2	1	1	1	-5
SOUTH	Inarajan	1	1	0	1	-26
CENTRAL	Mangilao	15	10	10	10	14
SOUTH	Merizo	1	1	10	1	-15
CENTRAL	Mongmong- Toto-Maite (MTM)	4	3	4	4	17
CENTRAL	Piti	3	2	5	1	-13
SOUTH	Santa Rita	7	5	0	4	-19
CENTRAL	Sinajana	8	6	4	2	-9
SOUTH	Talofofo	9	6	6	2	-5
CENTRAL	Tamuning	12	8	10	12	9
SOUTH	Umatac	1	1	0	0	-12
NORTH	Yigo	15	10	10	13	6
SOUTH	Yona	10	7	2	4	0
Total		147	100	100	100	+2

^a The village for three completed surveys could not be determined.

^b Source: U.S. Census Bureau, 2010 Census for Guam.

^c Positive numbers indicate population growth between 2000 and 2010.

The majority of fishermen who responded to the survey described themselves as Chamorro (72%) followed by White (23%) with relatively small proportions of Filipinos (6%), Micronesians (6%), other ethnicities (5%), and Carolinians (1%). As shown in Table 6, Guam fishermen are more likely to identify themselves as Chamorro relative to the general population of the island of Guam, based on data from the 2010 Guam Census. In considering the composition of the Guam small boat fleet, it would be reasonable to assume that our respondent population is slightly under representative of Filipino and Micronesian small boat fishermen⁵. Efforts to engage these groups were less successful than the investigators had hoped. Further study would be needed to better understand whether fishing behaviors of these populations differ significantly from other groups on the island.

⁵ B. Tibbats, Guam Division of Aquatic and Wildlife Resources, Pers. commun., 2012

Table 6.--Survey Responses: “How would you describe your race?”

Percentage of Responses [n]	Chamorro (%)	White (%)	Filipino (%)	Carolinian (%)	Micronesian (%)	Other (%)	Two or More (%)
Full Sample [145]	72.4	22.8	6.2	1.4	5.5	4.8	14.5
Guam Census (2010)	41.1	7.8	29.0	0.0	12.5	9.6	9.4
<i>GFCMA Membership</i>							
Yes [78]	74.4	25.6	9.0	2.6	3.9	5.3	21.8
No [68]	70.6	19.1	2.9	0.0	7.3	4.4	5.9
<i>Sell Fish</i>							
Yes [101]	77.2	20.8	5.0	2.0	5.9	5.3	16.8
Highliner [15]	80.0	26.7	6.7	6.7	0.0	0.0	20.0
Not highliner [86]	76.7	19.8	4.7	1.2	7.0	5.8	16.3
No [45]	62.2	26.7	8.9	0.0	4.4	4.0	8.9
<i>Primary Target</i>							
Pelagics [91]	69.2	27.5	4.4	2.2	5.5	6.6	17.6
Bottomfish [19]	84.2	15.8	0.0	0.0	5.3	0.0	5.3
Reef fish [13]	69.2	15.4	15.4	0.0	7.7	0.0	7.7
No primary [23]	78.3	13.0	13.0	13.0	4.4	4.4	13.0
<i>Boat Ownership</i>							
Yes [100]	71.0	25.0	8.0	1.0	5.0	3.0	17.0
No [45]	75.6	17.8	2.2	2.2	6.7	9.1	8.9

The overwhelming majority of fishermen (89%) reported to be employed full-time (76%), part-time (6%) or self-employed (7%), as shown in Table 7. As suggested by the age distribution presented in Table 2, nearly 7% of survey respondents indicated that they were currently retired. Unemployment rates for fishermen who responded to the survey (3%) were well below Guam’s general population unemployment figures that were reported at 13% in March 2011, coinciding with the survey fielding (Guam Department of Labor, 2012).

Table 7.--Survey Responses: “Are you currently employed?”

Percentage of Responses [n]	Employed Full Time (%)	Employed Part Time (%)	Retired (%)	Student Full Time (%)	Unemployed (%)	Self-Employed (%)
Full Sample [144]	76.4	6.3	6.9	0.7	2.8	6.9
<i>GFCMA Membership</i>						
Yes [77]	72.7	7.8	9.1	1.3	1.3	7.8
No [67]	80.5	4.5	4.5	0.0	4.5	6.0
<i>Sell Fish</i>						
Yes [99]	72.7	7.1	8.1	1.0	2.0	9.1
Highliner [15]	73.3	6.7	0.0	0.0	6.7	13.3
Not highliner [84]	72.7	7.1	9.5	1.2	1.2	8.3
No [45]	84.5	4.4	4.4	0.0	4.4	2.3
<i>Primary Target</i>						
Pelagics [91]	75.8	7.7	6.6	1.1	1.1	7.7
Bottomfish [19]	84.2	5.3	10.5	0.0	0.0	0.0
Reef fish [11]	72.7	0.0	0.0	0.0	27.3	0.0
No primary [23]	73.9	4.4	8.7	0.0	0.0	13.0
<i>Boat Ownership</i>						
Yes [100]	74.0	6.0	9.0	1.0	2.0	8.0
No [44]	81.8	6.8	2.3	0.0	4.6	4.6

As a group, survey respondents were generally well educated with more than 69% reporting to have completed some college, hold an associate's degree, or hold a bachelor's degree or higher (Table 8). GFCA members reported having slightly higher levels of education relative to non-GFCA members. Moreover, we find higher education among the fishing community relative to the general population (U.S. Census Bureau, 2012).

Table 8.--Survey Responses: "What is the highest level of education you have completed?"

Percentage of Responses [n]	Less than High School Graduate (%)	High School Graduate (%)	Some College or Associate's Degree (%)	Bachelor's Degree or higher (%)
Full Sample [144]	6.3	25.0	45.1	23.6
Guam Census (2010)	20.6	33.8	25.3	20.4
<i>GFCA Membership</i>				
Yes [77]	6.5	24.7	38.9	29.9
No [67]	6.0	25.4	52.2	16.4
<i>Sell Fish</i>				
Yes [100]	9.0	23.0	46.0	22.0
Highliner [15]	13.3	13.3	40.0	33.3
Not highliner [85]	8.2	24.7	47.1	20.0
No [44]	0.0	29.5	43.2	27.3
<i>Primary Target</i>				
Pelagics [91]	8.8	20.9	47.3	23.1
Bottomfish [19]	5.3	26.3	57.9	10.5
Reef fish [11]	0.0	63.6	0.1	27.3
No primary [23]	0.0	21.7	43.5	34.8
<i>Boat Ownership</i>				
Yes [100]	6.0	25.0	44.0	25.0
No [44]	6.8	25.0	47.7	20.5

The median household income of survey respondents, using the medians of survey response categories, was \$62,500 compared with the 2010 median of \$39,052 for the island of Guam (Bureau of Statistics and Plans, 2011). Likewise, the average household income for survey respondents was \$66,780 compared with the 2010 average of \$49,263. While this could be a function of the large income categories presented on the survey, using the lower limit of the income categories still arrives at an average household income of \$55,530. As suggested by the educational attainment results, household income for fishermen responding to the survey was found to be distributed slightly higher in comparison to the general population of Guam (Table 9). Nearly 23% of the Guam general population lives below the U.S. poverty level, which has important implications on local fish demand as well as fishing effort (U.S. Census Bureau, 2012). This supports patterns of fish flow throughout the community and the role of fishing in local food security as described in the social aspects of fishing section of this report. In addition, many fishermen cited economic conditions in describing their perceptions of future fishing participation as described in the fisher perceptions portion of this report.

Table 9.--Survey Responses: “What was your total household income, before taxes, in 2010, including fishing income?”

Percentage of Responses [n]	Less than \$15,000 (%)	\$15,000 - \$34,999 (%)	\$35,000 - \$74,999 (%)	\$75,000 - \$99,999 (%)	\$100,000 - \$149,999 (%)	\$150,000 or more (%)
Full Sample [132]	11.4	14.4	38.6	17.4	11.4	6.8
<i>GFCA Membership</i>						
Yes [70]	8.7	10.0	50.0	17.1	7.1	7.1
No [62]	14.5	19.4	25.8	17.7	16.1	6.5
<i>Sell Fish</i>						
Yes [92]	13.0	13.0	38.0	20.7	9.8	5.5
Highliner [14]	7.2	0.0	35.7	35.7	14.3	7.1
Not highliner [78]	14.1	15.4	38.5	18.0	8.9	5.1
No [40]	7.5	17.5	40.0	10.0	15.0	10.0
<i>Primary Target</i>						
Pelagics [84]	8.3	17.9	36.9	17.9	10.7	8.3
Bottomfish [18]	5.6	11.1	55.6	16.7	11.1	0.0
Reef fish [9]	55.6	0.0	11.1	22.2	11.1	0.0
No primary [21]	9.5	9.5	42.9	14.3	14.3	9.5
<i>Boat Ownership</i>						
Yes [94]	8.5	10.6	40.4	19.2	12.8	8.5
No [38]	18.4	23.7	34.2	13.2	7.9	2.6

Vessel Characteristics

This section presents a profile of fishing vessels that are currently active in Guam. The majority of survey respondents (69%) reported that they own the vessel on which they fish. While there was some item nonresponse for questions addressing vessel characteristics, the high rates of vessel ownership ensure that our survey respondents are familiar with vessel specifications, fishing activities, operations, and investment levels presented later in this report.

As shown in Table 10, the average fishing vessel in the Guam fleet is trailered, approximately 21 feet long with 168 horsepower, was built in the early 1990s, and purchased in the early 2000s. We find few differences in the vessel profile across subgroups in the fishery. The majority of larger vessels on Guam (greater than 21 feet) are primarily pelagic fishing boats, whereas those primarily targeting bottomfish and reef fish are almost exclusively less than 21 feet long (Table 11). Nearly 85% of vessels in the fleet use gasoline motors, and diesel engines (the remaining 15% of the fleet) are limited to vessels larger than 21 feet.

Table 10.--Vessel characteristics: means, standard errors, and medians.

Variable [n]		Full sample [87]	Sell Fish		Noncommercial [18]
			Highliner [12]	Not Highliner [57]	
Total length of boat (feet)	Mean	21.3	22.6	21.0	21.3
	Standard error	0.6	1.8	0.6	1.4
	Median	20.0	25.0	20.0	19.5
Boat	Mean	168	193	173	138
Horsepower	Standard error	13.2	33.4	17.9	19.3
	Median	140	218	140	128
Age of boat (years)	Mean	20.3	18.9	20.1	21.6
	Standard error	1.2	2.8	1.5	2.7
	Median	21.0	16.0	21.0	22.0
Current boat ownership (years)	Mean	7.8	5.5	8.5	7.4
	Standard error	0.6	1.1	0.8	1.5
	Median	6.0	4.0	6.0	5.0

Table 11.--Distribution of vessel size, by classification.

Percentage of Responses [n]	< 16 ft. (%)	16 – 20 ft. (%)	21 – 25 ft. (%)	25 – 30 ft. (%)	> 30 ft. (%)
Full Sample [97]	6.2	49.5	29.9	6.2	8.3
<i>GFCA Membership</i>					
Yes [61]	3.3	49.2	34.4	6.6	6.6
No [36]	11.1	50.0	22.2	5.6	11.1
<i>Sell Fish</i>					
Yes [75]	6.7	46.6	32.0	6.7	8.0
Highliner [12]	16.7	25.0	33.3	16.7	8.3
Not highliner [63]	4.7	50.8	31.8	4.8	7.9
No [22]	4.5	59.1	22.7	4.6	9.1
<i>Primary Target</i>					
Pelagics [68]	4.4	39.7	36.8	7.3	11.8
Bottomfish [15]	0.0	80.0	13.3	6.7	0.0
Reef fish [4]	25.0	75.0	0.0	0.0	0.0
No Primary [10]	20.0	60.0	20.0	3.9	3.9

Survey respondents provided evidence that sharing of fishing vessels is common among the Guam small boat fleet (Table 12). This is consistent with previous research findings that a portion of fishing vessels are co-owned and fished by multiple fishermen (Vaughn et al., 2000; Calvo⁶). On average, nearly 45% of vessel owners indicated that their vessel is used, at least part of the time, without the boat owner on board. This supports the strong community aspect of fishing that is characteristic of fishermen on Guam.

⁶ J. Calvo, Western Pacific Regional Fishery Management Council. Pers. commun., 2012.

Table 12.--Survey Response: “Do other people use the boat without you?”

Percentage of Responses [n]	Never (%)	Rarely (%)	Sometimes (%)	Often (%)
Full Sample [100]	55.0	25.0	15.0	5.0
<i>GFCA Membership</i>				
Yes [64]	56.3	23.4	17.2	3.1
No [36]	52.8	27.8	11.1	8.3
<i>Sell Fish</i>				
Yes [77]	54.5	28.6	14.3	2.6
Highliner [12]	50.0	33.3	16.7	0.0
Not highliner [65]	55.3	27.7	13.9	3.1
No [23]	56.5	13.0	17.5	13.0
<i>Primary Target</i>				
Pelagics [69]	52.2	27.5	15.9	4.4
Bottomfish [15]	66.7	20.0	13.3	0.0
Reef fish [5]	40.0	20.0	40.0	0.0
No Primary [11]	63.6	18.2	0.0	18.2

Fishing Activity

This section details fishing activity and operational aspects of Guam’s small boat fleet. Information presented in this section includes fishing avidity, trip characteristics, temporal and spatial descriptions of fishing trips, species targeting, and catch estimates. A detailed description of fishing activities will provide useful information for managers to understand the dynamics and heterogeneity of the fleet.

This section will characterize the overall fishing avidity of Guam’s boat fishing participants to better understand their fishing portfolio and reliance on various fishery resources. Using the medians of survey response bins, on average, the survey sample reported 39 boat fishing trips in the past 12 months. Fishermen reporting the sale of fish took more fishing trips (47 trips) on average, relative to noncommercial fishermen (21 trips). The distribution of total fishing trips taken in the past 12 months is presented in Table 13. Fishermen reporting the sale of fish typically spend more time out on the water with an average trip length of about 9.5 hours compared to approximately 7.7-hour trips taken by noncommercial fishermen.

On average, fishermen reported three people on board while fishing (see Tables 14 and 15). About one third (38%) of the fleet reported to be, on average, a two-person operation with a captain and one crew member, while another third (32%) typically fish with one captain and two crew members. A mere 7% of fishermen reported to always fish alone.

As shown in Tables 14 and 15, nearly 53% ($n = 76$) of survey respondents reported that they always fish out of the same harbor or boat ramp. Fishery highliners (60%) were most likely to use multiple harbors, while noncommercial fishermen (56%) were most likely to use the same harbor. Likewise, commercial fishermen reported a higher average one-way distance traveled to launch their vessel at 22 miles, relative to the noncommercial fishermen who averaged approximately 16 miles.

Table 13.--Survey Responses: "Approximately how many total fishing trips did you take over the past 12 months?"

Percentage of Responses [n]	Fewer than 12 trips	12 – 24 trips	25 – 49 trips	50 – 99 trips	100 - 200 trips	More than 200 trips
Full Sample [146]	30.8	30.8	15.1	13.7	6.2	3.4
<i>GFCAMembership</i>						
Yes [78]	24.3	32.1	15.4	17.9	7.7	2.6
No [68]	38.2	29.5	14.7	8.8	4.4	4.4
<i>Sell Fish</i>						
Yes [102]	22.5	30.4	16.7	17.7	8.8	3.9
Highliner [15]	13.3	33.3	20.0	26.7	0.0	6.7
Not highliner [87]	24.1	29.9	16.1	16.1	10.3	3.5
No [44]	50.0	31.8	11.4	4.6	0.0	2.2
<i>Primary Target</i>						
Pelagics [90]	30.0	35.6	13.3	13.3	5.6	2.2
Bottomfish [20]	20.0	30.0	25.0	15.0	10.0	0.0
Reef fish [13]	38.4	15.4	7.7	15.4	0.0	23.1
No target [23]	39.1	21.7	17.4	13.0	8.7	0.0
<i>Boat Ownership</i>						
Yes [101]	21.8	34.7	18.8	14.9	6.9	2.9
No [45]	51.2	22.2	6.7	11.1	4.4	4.4

Table 14.--Boat fishing trip characteristics, by classification: means, standard errors, and medians.

Variable [n]		Full Sample [146]	Sell Fish Highliner [15]	Sell Fish Not Highliner [87]	Noncommercial [44]
Number of fishing trips	Mean	39	48	47	21
	Standard error	3.9	12.8	5.6	4.8
	Median	18	37	18	12
Trip length (hours)	Mean	8.9	9.5	9.4	7.7
	Standard error	0.3	0.9	0.4	0.3
	Median	8.0	8.0	9.0	8.0
Fishing hours	Mean	7.2	7.4	7.8	6.0
	Standard error	0.3	0.9	0.5	0.3
	Median	6.0	6.0	8.0	6.0
Fishermen on board for an average fishing trip	Mean	3	2	3	3
	Standard error	0.0	0.2	0.1	0.1
	Median	3	2	3	3
How many different ramps/ harbors did you use in past 12 months?	Mean	2	2	2	2
	Standard error	0.0	0.3	0.1	0.1
	Median	1	2	1	1
Average distance traveled to launch boat (miles, one-way)	Mean	20.4	19.5	22.7	16.1
	Standard error	1.5	4.4	2.1	1.9
	Median	15.5	15.0	18.0	15.0

Table 15.--Boat fishing trip characteristics, by primary target: means, standard errors, and medians.

Variable [n]		Pelagics [90]	Bottomfish [20]	Reef Fish [13]	No primary [23]
Number of fishing trips	Mean	36	42	66	36
	Standard error	4.6	9.6	22.3	8.9
	Median	18	28	18	18
Trip length (hours)	Mean	9.1	8.9	7.7	8.4
	Standard error	0.4	0.5	0.6	0.6
	Median	8.0	8.0	7.0	8.0
Fishing hours	Mean	7.3	7.9	6.6	6.5
	Standard error	0.3	1.1	1.5	0.6
	Median	7.0	7.0	6.0	5.0
Fishermen on board for an average fishing trip	Mean	3	3	4	3
	Standard error	0.1	0.3	0.4	0.2
	Median	3	3	3	3
How many different ramps/harbors did you use in past 12 months?	Mean	1	2	2	2
	Standard error	0.0	0.2	0.3	0.2
	Median	1	2	2	2
Average distance traveled to launch boat (miles, one-way)	Mean	21.1	20.2	18.4	19.2
	Standard error	1.7	5.6	4.4	4.2
	Median	18.0	12.0	12.5	10.0

Guam small boat fishermen utilize many gear types and target many different species throughout the year (see Tables 16 and 17). On average, fishermen reported the use of 3 different gear types/target species in the past 12 months. This diversity of gear usage applied across all subgroups of the fleet. Trolling for pelagics is by far the most popular gear type (95% participated in the past 12 months), followed by fishing for shallow-water (59%) and deepwater (57%) bottomfish.

Table 16.--Percentage of fishermen using gear types on a boat fishing trip in the past 12 months, by classification.

Gear Type/ Target species [n]	Full Sample [147]	Sell Fish		Noncommercial [45]
		Highliner [15]	Not Highliner [87]	
Trolling	95.2	100.0	94.2	95.6
Deepwater bottomfish	56.5	66.7	60.9	44.4
Shallow-water bottomfish	58.5	66.7	55.2	62.2
Atulai	32.6	40.0	40.2	15.6
Spearfishing	32.0	40.0	31.1	31.1
Net fishing	8.2	6.7	8.1	8.9
Other	3.4	6.7	3.4	2.2

Table 17.--Percentage of fishermen using gear types on a boat fishing trip in the past 12 months, by primary target.

Gear Type/ Primary Target [n]	Pelagics [91]	Bottomfish [20]	Reef Fish [13]	No primary [23]
Trolling	100.0	95.0	69.2	91.3
Deepwater bottomfish	51.6	90.0	46.1	52.2
Shallow-water bottomfish	48.3	75.0	76.9	73.9
Atulai	30.8	50.0	23.1	30.4
Spearfishing	19.8	25.0	100.0	47.8
Net fishing	4.4	15.0	38.5	0.0
Other	4.4	0.0	0.0	4.4

Fishermen were asked what percentage of their fishing trips in the past 12 months were *primarily* various gear types. Survey respondents, on average, reported that approximately 63% of their boat fishing trips in the past 12 months consisted of trolling trips. Fishery highliners reported a higher percentage of trolling trips (76%) relative to other fishermen who sold fish (62%) and noncommercial fishermen (61%). Likewise, in general, bottomfish fishing appears to be associated more with less commercially motivated fishermen.

GFCA members were more likely to be primarily pelagic fishermen (73%) relative to non-GFCA members (49%), and they are subsequently more likely to sell fish (88%) relative to non-GFCA members (48%), as 73% of fishery highliners in our sample are GFCA members. However, the proportion of fishery highliners is not significantly different between GFCA members (16%) and non-GFCA members (12%).

Table 18.—Survey Responses: “In the past 12 months, what percentage of your fishing trips were primarily...”

Percentage of Responses [n]	Trolling	Deep Bottomfish	Shallow Bottomfish	Atulai	Reef Fishing Spear	Reef Fishing Net	Other
Full Sample [147]	62.8	13.6	10.8	3.0	8.3	1.0	0.5
<i>GFCA Membership</i>							
Yes [78]	70.8	12.6	7.6	2.5	5.3	0.8	0.4
No [69]	53.9	14.6	14.4	3.7	11.9	1.2	0.3
<i>Sell Fish</i>							
Yes [102]	63.8	14.5	9.0	3.8	7.4	1.0	0.5
Highliner [15]	76.1	7.1	7.8	2.1	7.9	0.7	0.3
Not highliner [87]	61.9	15.8	9.2	4.1	7.3	1.1	0.6
No [45]	60.5	11.3	14.9	1.3	10.6	0.9	0.5
<i>Primary Target</i>							
Pelagics [91]	83.6	6.8	5.0	1.9	1.8	0.3	0.6
Bottomfish [20]	24.8	43.8	23.7	4.3	2.5	0.9	0.0
Reef fish [13]	17.9	9.0	10.7	3.2	51.5	7.7	0.0
No primary [23]	38.6	16.4	22.7	6.2	15.0	0.0	1.1
<i>Boat Ownership</i>							
Yes [101]	65.7	13.7	9.9	3.0	6.7	0.5	0.5
No [46]	59.2	13.0	11.4	2.6	11.7	1.4	0.7

Nearly all boat fishing trips (91%) in the past 12 months were single day (or night) trips (see Table 19). This finding holds across nearly all subgroups in the fishery with the exception of fishermen primarily targeting reef fish (22%) and bottomfish (12%) who reported that a slightly larger portion of their fishing trips were multiday trips (Table 19). This is potentially the result of fishermen traveling to offshore banks located both north and south of Guam for spearfishing or bottomfish fishing. Seventy-three percent of survey respondents stated that 100% of their fishing trips are single day or night trips. Only 2% of fishermen reported that all their trips are multiday trips.

Table 19.--Survey Responses: “In the past 12 months, what percentage of your fishing trips were...”

Percentage of Trips [n]	Single day/ night trips (%)	Multiday trips (%)
Full Sample [146]	91.1	8.9
<i>GFCA Membership</i>		
Yes [77]	91.9	8.1
No [69]	90.1	9.9
<i>Sell Fish</i>		
Yes [101]	89.6	10.4
Highliner [15]	98.3	1.7
Not highliner [86]	88.1	10.9
No [45]	94.3	5.7
<i>Primary Target</i>		
Pelagics [91]	93.1	6.9
Bottomfish [20]	87.8	12.2
Reef fish [13]	78.1	21.9
No primary [22]	93.6	6.4

As shown in Table 20, our survey respondents indicated that their fishing trips in the past 12 months were rather evenly distributed across local (< 3 nm) and federal waters (3 – 200 nm). There are few clear differences in spatial behavior across avidity levels and target species, with the exception of fishermen that primarily target reef species, as they reported very few trips that were *exclusively* in federal waters.

Table 20.--Survey Responses: “In the past 12 months, what percentage of your *fishing* trips did you fish in...”

Percentage of Trips [n]	Local Waters Only (0-3 nm) (%)	Federal Waters Only (3-200 nm) (%)	Both Local and Federal Waters (%)
Full Sample [143]	30.9	28.9	40.2
<i>GFCA Membership</i>			
Yes [78]	21.8	36.9	41.3
No [65]	41.9	19.3	38.8
<i>Sell Fish</i>			
Yes [100]	26.0	33.8	40.2
Highliner [15]	14.3	28.7	57.0
Not highliner [85]	28.1	34.7	37.2
No [43]	42.3	17.6	40.1
<i>Primary Target</i>			
Pelagics [89]	25.7	36.5	37.8
Bottomfish [19]	35.5	19.9	44.5
Reef fish [13]	46.1	6.6	47.3
No primary [22]	39.2	19.2	41.6

Fishermen reported a significant amount of effort at offshore Fish Aggregating Devices (FADs). Approximately 96% of Guam fishermen reported to have fished at FADs in the past 12 months, reporting on average that FADs were used on 53% of fishing trips (see Table 21). The importance of FADs to Guam fishing operations is clear across all subgroups of the fishery. It should be noted that in recent years, only about 33% (5 out of 15) of designated FADs have been online and in the water for fishermen to use (Calvo⁷).

Table 21.--Survey Responses: “In the past 12 months, how many of your fishing trips did you fish at Fish Aggregating Devices (FADs)?”

Percentage of Trips [n]	Mean (%)	St. Error	Median
Full Sample [138]	53.2	2.8	49.5
<i>GFCA Membership</i>			
Yes [74]	56.5	3.8	74.5
No [64]	49.4	4.0	49.5
<i>Sell Fish</i>			
Yes [97]	53.6	3.2	49.5
Highliner [14]	54.5	6.4	49.5
Not highliner [83]	53.5	3.6	74.5
No [41]	52.0	5.4	49.5
<i>Primary Target</i>			
Pelagics [88]	55.4	3.5	74.5
Bottomfish [18]	56.4	7.6	62.0
Reef fish [11]	42.4	10.4	49.5
No primary [21]	46.8	6.3	49.5
<i>Boat Ownership</i>			
Yes [98]	56.7	3.3	74.5
No [40]	44.6	4.7	49.5

⁷ J. Calvo, Western Pacific Regional Fishery Management Council. Pers. commun., 2012.

Survey respondents reported that bottomfish and reef fish species fishing was highly seasonal, relative to pelagic fishing (see Fig. 3). Clearly, weather patterns have a great influence on the scale of Guam fishing effort. Just over half of the survey respondents (54%) reported to fish all year for pelagics, whereas only 16% fish year-round for bottomfish and reef fish. As one would expect, year-round fishing was dominated by more commercially oriented fishermen. In general, GFCA members were more avid then nonmembers. The distribution of fishing effort by quarter, as reported by subgroups of the fishery, is presented in Figure 3 and Table 22.

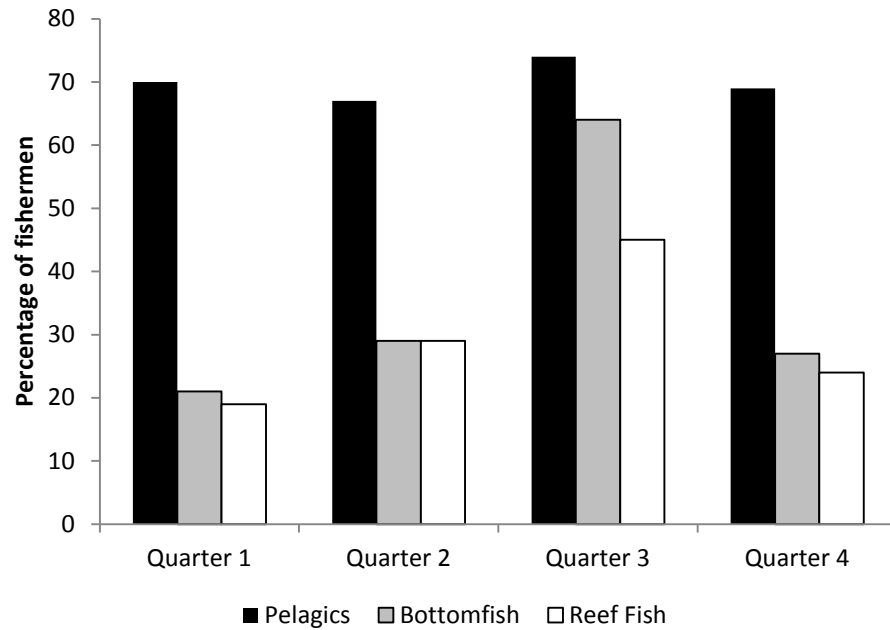


Figure 3.--Seasonality of fishing effort by target species

Table 22.--Survey Responses: “In the past 12 months, during which months did you fish for...”

Percentage of “YES” responses [n]	Pelagics				Bottomfish				Reef Fish			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Full Sample [144]	70	67	74	69	21	29	64	27	19	29	45	24
<i>GFCA Membership</i>												
Yes [75]	77	74	81	76	17	25	63	24	19	26	43	23
No [69]	62	60	65	61	24	34	66	31	19	33	48	25
<i>Sell Fish</i>												
Yes [100]	77	74	80	75	23	31	68	28	18	29	45	22
Highliner [15]	93	87	80	100	13	7	87	40	29	36	57	21
Not highliner [85]	74	72	80	71	25	35	65	26	17	27	43	23
No [44]	55	52	59	55	14	26	56	26	21	31	45	29
<i>Primary Target</i>												
Pelagics [91]	78	78	82	74	13	21	58	22	11	19	34	16
Bottomfish [18]	67	56	67	67	44	61	83	50	28	28	39	22
Reef fish [13]	23	31	39	23	23	15	62	15	46	61	92	69
No primary [22]	68	55	64	77	27	45	77	36	29	52	67	33

Q1 = Jan-Mar, Q2 = Apr-Jun, Q3 = Jul-Sep, Q4 = Oct-Dec

While the survey was not designed specifically to determine annual catch levels for the fleet, we asked fishermen to report estimates of catch in the past 12 months by broad species groups (pelagics, bottomfish, and reef fish), in an effort to explore the relationship between economic expenditures and the scale of fishing effort. Using the midpoints of catch categories presented on the survey, fishermen reported an average of 1384 pounds of pelagic fish caught in the past 12 months, although the median of 150 pounds suggests high levels of variability in catch amounts within the fishery due to the high amount of reported catch from fishery highliners (see Table 23). Reported catch for bottomfish and reef fish were significantly lower than pelagics, with an average of 157 pounds of bottomfish and 92 pounds of reef fish reported by our survey respondents (see Table 23). Efforts were made to determine estimates of trip-level catch averages using the reported number of trips, by gear type, although there was some item nonresponse from a few fishery highliners so these estimates could be potentially biased downward. The distributions of catch, by species group, are presented in Tables 25 – 27.

Table 23.—Reported pounds caught in past 12 months, by classification: means, standard errors, and medians.

Variable [n]		Full Sample [146]	Sell Fish Highliner [15]	Not Highliner [87]	Non Commercial [44]
<i>Annual pounds caught</i>					
Total pelagic pounds caught	Mean	1384	8153	828	175
	Standard error	540	4724	306	48
	Median	150	2000	375	75
Total bottomfish pounds caught	Mean	157	400	159	71
	Standard error	27	199	29	13
	Median	75	150	75	50
Total reef fish pounds caught	Mean	92	217	90	53
	Standard error	17	103	20	17
	Median	13	75	13	13
<i>Trip-level pounds caught</i>					
Pelagic pounds per trip	Mean	58	186	48	30
	Standard error	11	64	12	11
	Median	21	117	21	10
Bottomfish pounds per trip	Mean	19	31	18	16
	Standard error	2	8	3	4
	Median	8	27	5	7
Reef fish pounds per trip	Mean	16	13	19	13
	Standard error	5	6	8	6
	Median	0	0	0	0

Table 24.—Reported pounds caught in past 12 months, by primary target: means, standard errors, and medians.

Variable [n]		Pelagics [90]	Bottomfish [19]	Reef Fish [13]	No primary [23]
<i>Annual pounds caught</i>					
Total pelagic	Mean	1595	1705	367	857
pounds caught	Standard error	816	1353	229	335
	Median	375	150	75	150
Total bottomfish	Mean	116	330	131	193
pounds caught	Standard error	36	82	74	51
	Median	25	150	75	75
Total reef fish	Mean	39	79	245	226
pounds caught	Standard error	9	32	75	80
	Median	0	13	75	38
<i>Trip-level pounds caught</i>					
Pelagic	Mean	46	99	25	64
pounds per trip	Standard error	12	49	9	21
	Median	21	17	10	25
Bottomfish	Mean	16	21	19	28
pounds per trip	Standard error	3	7	8	7
	Median	3	9	10	13
Reef Fish	Mean	7	36	25	29
pounds per trip	Standard error	2	29	17	12
	Median	0	0	6	0

Table 25.--Survey Responses: “In the past 12 months approximately how many total pounds of *pelagic fish* did **you** catch?”

Percentage of Responses [n]	None	1-50 pounds	51-100 pounds	101-250 pounds	251-500 pounds	More than 500 pounds
Full Sample [146]	3.4	10.2	17.1	24.7	15.8	28.8
<i>GFCA Membership</i>						
Yes [77]	1.3	6.5	11.7	19.5	23.4	37.6
No [69]	5.8	14.5	23.2	30.4	7.3	18.8
<i>Sell Fish</i>						
Yes [102]	2.0	5.9	13.7	20.6	18.6	39.2
Highliner [15]	0.0	0.0	0.0	0.0	0.0	100.0
Not-Highliner [87]	2.3	6.9	16.1	24.2	21.8	28.7
No [44]	6.8	20.5	25.0	34.1	9.1	4.5
<i>Primary Target</i>						
Pelagics [91]	1.1	5.5	15.4	27.5	18.7	31.8
Bottomfish [19]	5.3	21.0	15.8	15.8	15.8	26.3
Reef Fish [13]	15.4	15.4	23.1	30.7	0.0	15.4
No primary [23]	4.4	17.4	21.7	17.4	13.0	26.1
<i>Boat Ownership</i>						
Yes [101]	4.0	7.9	12.8	22.8	17.8	34.7
No [45]	2.2	15.5	26.7	28.9	11.1	15.6

Table 26.--Survey Responses: "In the past 12 months approximately how many total pounds of *bottomfish* did **you** catch?"

Percentage of Responses [n]	None	1-50 pounds	51-100 pounds	101-250 pounds	251-500 pounds	More than 500 pounds
Full Sample [146]	21.2	26.7	21.9	13.0	11.0	6.2
<i>GFCA Membership</i>						
Yes [77]	24.6	27.3	18.2	14.3	9.1	6.5
No [69]	17.4	26.1	26.1	11.6	13.0	5.8
<i>Sell Fish</i>						
Yes [102]	19.6	27.5	19.6	10.8	13.7	8.8
Highliner [15]	6.7	33.3	6.7	20.0	13.3	20.0
Not highliner [87]	21.8	26.5	21.8	9.2	13.8	6.9
No [44]	25.0	25.0	27.3	18.1	4.6	0.0
<i>Primary Target</i>						
Pelagics [91]	26.3	35.2	16.5	13.2	5.5	3.3
Bottomfish [19]	5.3	0.0	36.8	10.5	31.6	15.8
Reef fish [13]	15.3	30.8	30.8	15.4	0.0	7.7
No primary [23]	17.4	13.0	26.1	13.0	21.8	8.7
<i>Boat Ownership</i>						
Yes [101]	20.8	24.8	19.8	15.8	11.9	6.9
No [45]	22.2	31.1	26.7	6.7	8.9	4.4

Table 27.--Survey Responses: "In the past 12 months approximately how many total pounds of *reef fish* did **you** catch?"

Percentage of Responses [n]	None	1-25 pounds	26-50 pounds	51-100 pounds	101-250 pounds	More than 250 pounds
Full Sample [145]	42.8	14.5	10.3	11.7	11.0	9.7
<i>GFCA Membership</i>						
Yes [76]	44.7	13.2	4.0	15.8	11.8	10.5
No [69]	40.6	15.9	17.4	7.3	10.1	8.7
<i>Sell Fish</i>						
Yes [101]	41.5	12.9	7.9	13.9	11.9	11.9
Highliner [15]	40.0	0.0	0.0	26.7	13.3	20.0
Not highliner [86]	41.9	15.1	9.3	11.6	11.6	10.5
No [44]	45.5	18.1	15.9	6.8	9.1	4.6
<i>Primary Target</i>						
Pelagics [90]	54.5	14.4	6.7	13.3	10.0	1.1
Bottomfish [19]	47.4	5.3	15.8	10.5	10.5	10.5
Reef fish [13]	0.0	15.3	23.1	15.4	7.7	38.5
No primary [23]	17.4	21.7	13.0	4.4	17.4	26.1
<i>Boat Ownership</i>						
Yes [100]	49.0	9.0	6.0	13.0	12.0	11.0
No [45]	28.9	26.7	20.0	8.9	8.9	6.6

Using data from the Guam DAWR creel surveys, during 2010-2011, it is estimated that Guam's small boat fishermen caught an average of approximately 893,000 pounds of all fish species per year (WPacFIN, 2012). There was high annual variability between 2010 and 2011 due in part to weather considerations and estimation procedures as well as the logistics of creel survey implementation.

The aggregate reported catch for fishermen in our sample was approximately 238,000 pounds, nearly 27% of total estimated annual boat landings of 893,000 pounds across 2010 and 2011 (see Table 28). However, again, our estimated aggregate catch from our survey respondents is likely biased downward due to item nonresponse from a few fishery highliners⁸. The majority of aggregate catch from our survey respondents was made up of pelagic fish (85%), followed by bottomfish (9%) and reef fish (5%). Our results compare relatively well to the share of annual landings, by fishing method, as estimated by WPacFIN. The total estimated average boat-based landings across 2010 and 2011 was 74% trolling catch, 8% bottomfish, 8% spearfishing, and 9% “other” methods.

Table 28.--Estimated boat fishing landings: pounds caught, by method.

Gear Type (% share)	Troll	Bottom	Spear	Other ^b	Total
2010 ^a	586,962	88,910	93,931	138,296	908,100
2011 ^a	737,851	56,858	56,016	27,696	878,422
Average, 2010-2011 ^a	662,407 (74%)	72,884 (8%)	74,974 (8%)	82,996 (9%)	893,261
Survey Response	202,025 (85%)	22,535 (9%)	12,929 (5%)		238,372

^aSource: WPacFIN, 2012.

^bThe “other” gear method catch totals are dominated (77%) by bigeye scad (atulai), which is an inshore “pelagic” species. It would appear many fishermen responding to the survey included atulai in their pelagic catch estimates.

Market Participation and Access

During 2010 and 2011, the Guam small boat fishery had an estimated value of approximately \$0.92 million and \$0.68 million, respectively (WPacFIN, 2012). The values in these years continued downward trends seen in estimated commercial values over the past decade. Previously, Guam law required the government of Guam to provide locally caught fish to food services in government agencies, such as the Department of Education and Department of Corrections. In 2001, the government of Guam began implementing cost-saving measures, including privatization of food services. Enforcement of the “locally caught” provisions has been reduced since privatization allowing private contractors to import cheaper foreign fish, resulting in reduced sales by vendors selling locally caught fish. (Tibbats and Flores, 2012). Average fish prices in 2010 and 2011 were approximately \$2.49 and \$2.55 per pound, respectively.

There is clearly an economic incentive for some fishery participants with access to markets to sell their fish, especially when considering the costs of fishing (to be detailed in the next section of this report). However, we found that nearly 30% of survey

⁸ Fishermen reporting the highest catch category were asked to specify an approximate catch total. Approximately 33% ($n = 14$) did not specify a catch total for pelagic fish caught, 44% ($n = 4$) for bottomfish and 14% ($n = 2$) for reef fish. For these nonrespondents, we simply used the median of those responding in calculating the aggregate catch estimates for the survey sample. This very well could put a downward bias on our aggregate catch estimates, especially when considering the scale of catch. Responses ranged from 800 pounds to approximately 70,000 pounds.

participants reported that they had *not* sold any fish in the past 12 months, and nobody reported to have sold all the fish they caught. On average, fishermen that reported the sale of fish indicated that they sold fish after approximately 59% of their fishing trips occurring in the past 12 months. Fishery highliners were the most active in the market, selling catch nearly 84% of the time. For the majority of the fleet, there is considerable heterogeneity in market participation and access. The average percentage of trips after which sales occurred in the past 12 months, based on survey responses for subgroups of the Guam small boat fleet, are presented in Table 29. The distribution of survey responses is presented in Table 30.

Table 29.--Survey Responses: In the past 12 months, after what percentage of your fishing trips did you sell a portion of your catch? (*all responses*)

Percentage Sold [n]	Mean (%)	St. Error	Median
Full Sample [143]	40.3	3.1	49.5
<i>GFCA Membership</i>			
Yes [74]	56.1	3.9	74.5
No [69]	23.3	3.9	0.0
<i>Sell Fish</i>			
Yes [98]	58.8	3.0	74.5
Highliner [15]	83.5	4.9	95.0
Not highliner [83]	54.3	3.2	49.5
<i>Primary Target</i>			
Pelagics [89]	45.3	3.9	49.5
Bottomfish [19]	34.8	8.2	24.5
Reef fish [12]	22.7	8.9	0.0
No primary [23]	34.6	7.6	24.5
<i>Boat Ownership</i>			
Yes [98]	45.9	3.7	49.5
No [45]	27.9	5.1	0.0

Table 30.--Distribution of survey responses: In the past 12 months, after what percentage of your fishing trips did you sell a portion of your catch? (*all responses*)

Percentage of Responses [n]	Almost All (90%-100%)	Most (60%-89%)	About Half (40%-59%)	Some (10%-39%)	Very Few (1%-9%)	None
Full Sample [143]	16.1	19.6	15.4	9.8	7.7	31.5
<i>GFCA Membership</i>						
Yes [74]	22.9	31.1	17.6	8.1	8.1	12.2
No [69]	8.7	7.2	13.0	11.6	7.3	52.2
<i>Sell Fish</i>						
Yes [98]	23.5	28.5	22.5	14.3	11.2	0.0
Highliner [15]	60.0	33.3	0.0	6.7	0.0	0.0
Not highliner [83]	16.9	27.7	26.5	15.7	13.3	0.0
<i>Primary Target</i>						
Pelagics [89]	20.2	21.4	15.7	7.9	9.0	25.8
Bottomfish [19]	10.5	15.8	21.1	10.5	0.0	42.1
Reef fish [12]	0.0	16.7	16.7	8.3	0.0	58.3
No primary [23]	13.0	17.5	8.7	17.4	13.0	30.4
<i>Boat Ownership</i>						
Yes [98]	20.4	20.4	17.3	9.2	10.2	22.5
No [45]	6.7	17.8	11.1	11.1	2.2	51.1

In addition to the frequency of market participation, we sought to better understand the scale of participation in commercial markets. On average, fishermen that reported the sale of fish indicated that they sold approximately 35% of their total catch in the past 12 months. Largely by definition, fishery highliners sold the largest percentage of their catch at 69%, relative to other fishermen with sales, who sold about 29% of their catch. Cost recovery was cited as the primary motivation for the sale of fish. The average percentages of fish sold in the past 12 months, based on survey responses for subgroups of the Guam small boat fleet, are presented in Table 31. The distribution of survey responses is presented in Table 32.

Table 31.--Survey Responses: Percentage of fish sold (all responses).

Percentage Sold [n]	Mean (%)	St. Error	Median
Full Sample [147]	24.4	2.3	10.0
<i>GFCMA Membership</i>			
Yes [77]	33.3	3.3	25.0
No [70]	14.6	2.8	0.0
<i>Sell Fish</i>			
Yes [102]	35.1	2.8	25.0
Highliner [15]	69.1	3.0	70.0
Not highliner [87]	29.3	2.7	20.0
<i>Primary Target</i>			
Pelagics [91]	30.3	3.2	17.0
Bottomfish [20]	15.9	4.5	10.0
Reef fish [13]	8.1	4.7	0.0
No primary [23]	17.5	4.5	10.0
<i>Boat Ownership</i>			
Yes [101]	27.6	2.8	17.0
No [46]	17.2	4.1	2.5

Table 32.--Distribution of survey responses: Percentage of fish sold (all responses).

Percentage of Responses [n]	Almost All (90%-100%)	Most (60%-89%)	About Half (40%-59%)	Some (10%-39%)	Very Little (1%-9%)	None
Full Sample [147]	3.4	17.7	6.8	27.9	13.6	30.6
<i>GFCMA Membership</i>						
Yes [77]	5.2	27.2	6.5	32.5	16.9	11.7
No [70]	1.5	7.1	7.1	22.9	10.0	51.4
<i>Sell Fish</i>						
Yes [102]	4.9	25.5	9.8	40.2	19.6	0.0
Highliner [15]	13.3	80.0	6.7	0.0	0.0	0.0
Not highliner [87]	3.5	16.1	10.3	47.1	23.0	0.0
<i>Primary Target</i>						
Pelagics [91]	5.5	23.1	6.6	26.4	13.2	15.2
Bottomfish [20]	0.0	5.0	15.0	35.0	5.0	40.0
Reef fish [13]	0.0	7.7	0.0	7.7	30.7	53.9
No primary [23]	0.0	13.0	4.4	39.1	13.0	30.5
<i>Boat Ownership</i>						
Yes [101]	2.9	20.8	8.9	30.7	14.9	21.8
No [46]	4.3	10.9	2.2	21.7	10.9	50.0

As exact pounds sold and revenue totals were not a priority for this survey, and to assuage recall bias and confidentiality concerns, fishermen were given broad percentage sold and revenue categories so we could understand market participation within the fleet in general terms (see Appendix A). The average pounds sold of all fish species combined (pelagics, bottomfish, and reef fish) and gross revenues, using the medians of revenue categories and self-reported revenues for those earning revenues greater than the highest revenue category (\$10,000), are presented in Table 33. The means estimates are significantly higher than the medians, suggesting that the means are heavily influenced by fishery highliners who clearly are much more commercially active. Estimated approximations for pounds sold and revenues per trip (using reported percentage of trips with sales) are also provided. Additionally, the distribution of reported revenues in the past 12 months is shown in Figure 4.

Table 33.--Market participation in past 12 months: means, standard errors, and medians.

Variable [n]		Full Sample [147]	Sell Fish Sample ^a [102]	Highliner ^a [15]	Not Highliner ^a [87]
Pounds Sold	Mean	706	1017	5680	213
	Standard error	319	457	2891	39
	Median	50	115	1114	93
Pounds Sold per trip	Mean	26	38	124	23
	Standard error	6	8	39	4
	Median	04	12	78	10
Gross revenue (dollars)	Mean	2102	3029	8000	2172
	Standard error	492	691	3044	582
	Median	300	750	3000	300
Gross revenue (dollars), per trip	Mean	93	136	213	122
	Standard error	14	19	37	21
	Median	22	67	213	56

^aLimited to fishermen who reported the sale of fish in past 12 months.

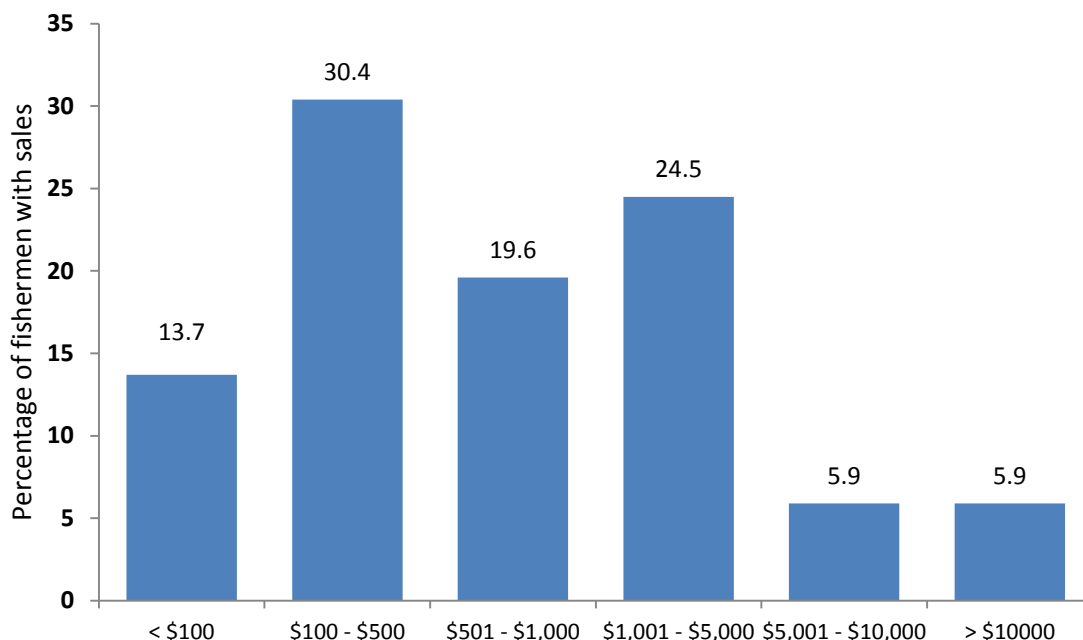


Figure 4.--Distribution of gross revenues in the past 12 months for fishermen reporting the sale of fish.

The aggregate revenue for survey respondents was approximately \$309,000. This is nearly 39% of the average estimated annual commercial revenues of \$800,000 across 2010 and 2011 (see Table 34). However, a caveat in our estimated aggregate revenue from our sample is that we used the medians of the revenue categories to calculate the total. Additionally, the pounds sold values are derived from the reported percentage of fish sold, as applied to reported total catch (and previously mentioned caveats associated with this estimate). Fishermen responding to our survey reported the sale of approximately 104,000 pounds of fish, equating to an average price of \$2.97.

Table 34.--Estimated boat fishing pounds sold and revenues

	Pounds Sold	Revenues	Average Price
2010 ^a	369,906	919,949	2.49
2011 ^a	265,483	677,765	2.55
Average, 2010-2011 ^a	317,695	798,857	2.51
Survey Response (% estimated total)	103,736 (33%)	309,000 (39%)	2.97

^aSource: WPacFIN, 2012

Guam fishermen reported a moderate reliance on fishing as a source of personal income, although clearly the overwhelming majority of fishermen do not rely on fishing revenues as a primary source of income, and cost recovery serves as a primary motivation for fish sales. On average, across the fleet, using the medians of survey response categories, fishermen who sold fish reported approximately 18% of personal income from the sale of fish (Table 35). We found few significant differences across subgroups of the fishery. The distribution of fishing income is presented in Table 36.

Table 35.--Survey Responses: “In the past 12 months, what percent of your personal income came from fishing?” (*for those who reported the sale of fish*).

Percentage of Personal Income [n]	Mean (%)	St. Error	Median
Full Sample [99]	17.7	1.9	5.0
<i>GFCA Membership</i>			
Yes [66]	16.5	2.2	5.0
No [33]	20.2	3.9	5.0
<i>Sell Fish</i>			
Highliner [15]	19.0	4.1	25.0
Not highliner [84]	17.5	2.2	5.0
<i>Primary Target</i>			
Pelagic [66]	15.1	2.5	5.0
Bottomfish [11]	28.1	4.8	25.0
Reef fish [6]	26.7	10.5	25.0
No primary [16]	18.1	3.9	15.0
<i>Boat Ownership</i>			
Yes [77]	17.9	2.3	5.0
No [22]	17.3	3.4	15.0

Table 36.--Survey Responses: “In the past 12 months, what percent of your personal income came from fishing?” (*for those who reported the sale of fish*).

Percentage of Responses [n]	Almost All (90%-100%)	Most (60%-89%)	About Half (40%-59%)	Some (10%-39%)	Very Little (1%-9%)
Full Sample [99]	2.0	2.0	8.1	29.3	58.6
<i>GFCA Membership</i>					
Yes [66]	1.5	1.5	6.1	31.8	59.1
No [33]	3.0	3.0	12.1	24.3	57.6
<i>Sell Fish</i>					
Highliner [15]	0.0	0.0	13.3	40.0	46.7
Not highliner [84]	2.4	2.4	7.1	27.4	60.7
<i>Primary Target</i>					
Pelagics [66]	3.0	1.5	4.6	21.2	69.7
Bottomfish [11]	0.0	0.0	27.3	54.6	18.1
Reef fish [6]	0.0	16.7	0.0	50.0	33.3
No primary [16]	0.0	0.0	12.5	37.5	50.0
<i>Boat Ownership</i>					
Yes [77]	2.6	1.3	10.4	24.7	61.0
No [22]	0.0	4.6	0.0	45.4	50.0

While the majority of survey respondents who reported the sale of fish (59%) considered fish revenues to contribute *very little* to their personal income, on average, nearly 67% of fishing income is derived from the sale of pelagic fish (Table 37). Fishery highliners rely more on pelagic revenues (81% of fishing income) than other fishermen who sell fish (64%). On average, survey respondents reported that 20% of fishing revenues are derived from bottomfish, and the remaining revenues from reef fish. As one may expect, the subgroups most reliant on revenues from bottomfish and reef are those fishermen for whom these are their respective target species. However, even these groups of fishermen report nearly half of fishing revenues are from pelagic fish.

Table 37.--Mean Survey Responses: “In the past 12 months, what percent of your fishing income came from...” (*for those who sold fish*)

Percentage Fishing Income [n]	Pelagics (%)	Bottomfish (%)	Reef Fish (%)
Full Sample^a [98]	66.7	19.1	14.2
<i>GFCFA Membership</i>			
Yes [32]	69.4	17.7	12.9
No [66]	61.3	21.9	16.8
<i>Sell Fish</i>			
Highliner [15]	80.6	7.1	12.3
Not highliner [83]	64.2	21.3	14.5
<i>Primary Target</i>			
Pelagic [65]	76.8	14.2	9.0
Bottomfish [11]	45.4	45.3	9.3
Reef fish [6]	48.7	16.0	35.3
No primary [16]	47.2	22.2	30.6
<i>Boat Ownership</i>			
Yes [76]	68.1	18.4	13.4
No [22]	61.9	21.5	16.6

^aLimited to fishermen who reported the sale of fish in past 12 months.

The Guam Fisherman’s Cooperative Association (GFCFA) is the primary local market for fish sales and purchases in Guam. In 2006, the GFCFA sold an estimated 30% of all reef fish and bottomfish and about 70% of all pelagic fish landed on Guam (Allen and Bartram, 2008). Unfortunately, recent years have seen steady declines in the market demand for fresh local fish across Guam; however, the GFCFA continues, as it has for more than 36 years, to serve as a viable market for the Guam fishing community and local consumers. In addition to marketing services, the GFCFA provides subsidized fuel and ice for its members, and also extends benefits through fisheries conservation efforts and marine education to the greater Guam community. The overwhelming majority of GFCFA members responding to the survey (81%) reported selling all their fish at the GFCFA, while 17% of GFCFA members also reported selling occasionally to friends.

Other avenues to sell fish include word of mouth through friends, neighbors or coworkers, and some fishermen even directly market their catch at farmers’ markets or by selling on the side of the road. Based on our survey respondents, we find that nearly 18% of fish is sold amongst friends and social networks, with minor sales (4%) to non-GFCFA retail markets, restaurants (3%), and farmers’ markets/roadside (3%). Average distributions by market channel, as reported by survey respondents are presented in Table 38, and the percentage of respondents who reported using each particular market outlet by county is presented in Table 39. On average, as one would expect, the majority of fish is sold directly to the GFCFA.

Table 38.--Survey Responses: “Where do you sell your catch?”

Percentage of Catch [n]	GFCA (%)	Roadside Dealer (%)	Retail Markets/ Stores (%)	Restaurants (%)	Friends/ Neighbors/ Coworkers (%)	Wholesaler (%)	Other (%)
Full Sample^a [102]	71.1	2.6	3.9	3.3	17.9	0.2	1.0
<i>GFCA Membership</i>							
Yes [68]	93.6	0.2	2.1	0.0	3.9	0.2	0.0
No [34]	26.4	7.4	7.5	9.7	45.9	0.0	3.1
<i>Sell Fish</i>							
Highliner [15]	80.0	1.0	2.2	8.9	7.9	0.0	0.0
Not highliner [87]	69.6	2.9	4.2	2.3	19.6	0.2	1.2
<i>Primary Target</i>							
Pelagics [68]	79.1	1.6	5.2	3.8	8.7	0.1	1.5
Bottomfish [12]	55.0	4.2	0.0	0.0	40.8	0.0	0.0
Reef fish [6]	36.7	1.5	7.5	0.3	52.5	1.5	0.0
No primary [16]	62.2	6.3	0.0	4.7	26.9	0.0	0.0

^aLimited to fishermen who reported the sale of fish in past 12 months.

Table 39.--Market Utilization, by classification: percentage of respondents using outlet

Market Outlet [n]	Full Sample ^a	Sell Fish	
	[102]	Highliner [15]	Not Highliner [87]
Guam Fisherman’s COOP	78.4	86.7	77.1
Roadside dealer	7.8	6.7	8.1
Retail markets/stores	10.8	6.7	11.5
Restaurants	7.8	13.3	6.9
Friends/neighbors/coworkers	31.4	26.7	32.2
Wholesaler	2.0	0.0	2.3
Other	2.0	0.0	2.3

^aLimited to fishermen who reported the sale of fish in past 12 months.

It would appear that a minority of fishermen use a diversity of market outlets, as only a quarter of survey respondents (25%) reported using more than one market outlet in the past 12 months, either by choice or by necessity (Table 40). For the purpose of this report, we simply consider market outlets as defined in Table 39. We do not have a distinction as to how many *different* markets or stores one may sell to, but we consider markets and stores as one market outlet. The overwhelming majority of fishermen sell exclusively to the GFCa, including non-GFCa members. Of note, non-GFCa members are the most active in diverse marketing of their catch.

Table 40.--Market Utilization: percentage of respondents using different outlets.

Number of Different Market Outlets Used [n]	Full Sample ^a [102]	Sell Fish		GFCA	
		Highliner [15]	Not Highliner [87]	Member [68]	Non Member [34]
One	75.5	73.3	75.9	80.9	64.7
Two	16.8	13.3	17.2	16.2	17.7
Three	3.9	13.3	2.3	3.0	8.8
Four	1.9	0.0	2.3	0.0	5.9
Five	1.9	0.0	2.3	0.0	2.9

^aLimited to fishermen who reported the sale of fish in past 12 months.

There do not appear to be significant market limitations for Guam fishermen. Nearly 82% indicated that they do not have difficulties selling all their catch, no matter the species, and we found little difference between GFCA members and nonmembers. Fishery highliners appear to have well-established market relationships, as 100% confirmed that they were able to sell all the catch they wanted to sell.

Table 41.--Survey Responses: "Can you usually sell all of your fish if you want to?"

Percentage of "YES" Responses [n]	<i>Pelagics</i>	<i>Bottomfish</i>	<i>Reef Fish</i>	<i>Sell all fish</i>
Full Sample^a [96]	89.6	91.0	90.9	82.1
<i>GFCAMembership</i>				
Yes [66]	89.4	94.0	94.3	81.3
No [30]	90.0	85.7	85.0	83.9
<i>Sell Fish</i>				
Highliner [15]	100.0	100.0	100.0	100.0
Not highliner [81]	87.7	89.4	89.1	79.0
<i>Primary Target</i>				
Pelagics [67]	94.0	93.8	90.3	85.7
Bottomfish [11]	72.7	83.3	83.3	72.7
Reef fish [5]	80.0	100.0	100.0	83.3
No primary [13]	84.6	84.6	91.7	73.3

^aLimited to fishermen who reported the sale of fish in past 12 months.

The survey included an open-ended probe for survey respondents who felt that they could not usually sell all of the fish they would have liked to sell. While the overwhelming majority indicated little difficulty in selling catch, a few respondents used the opportunity to elucidate reasons why. Market conditions were cited as limiting fishermen's ability to sell their catch, and additional reasons included the catch of undesirable/non-target species, the fish being too small and picky customers. Again, with a few exceptions, the emphasis on cost recovery proved to be the primary motivation for market participation.

Trip Costs

This section presents a snapshot of trip costs incurred by Guam boat fishing trips during 2010 and 2011. Fishermen surveyed were asked for the month and year of their most recent fishing trip to prompt recall and then asked to detail trip-related expenditures of

their most recent fishing trip for their two most common gear types (where applicable). For pelagic fishing trips taken in 2010 and 2011, the average trip cost approximately \$235 with a median cost of \$190 (see Table 42). As one may expect, fuel expenses were the largest contributor to total trip expenditures. The average pelagic fishing trip expenditures included \$147 for boat fuel and \$23 for truck fuel, leading fuel costs to account for a majority (72%) of total trip expenditures. Food and beverage was the next largest contributor to total trip costs at \$25 (11%), followed by ice (10%) and bait/tackle (7%). On average, fishermen with fish sales spent a larger percentage on fuel and ice than noncommercial fishermen, whereas noncommercial fishermen spent a larger percentage on food and beverage.

Table 42.--Most recent *pelagic* fishing trip costs, by classification: means, standard errors, and medians.

Variable [n]		Full Sample		Sell Fish				Noncommercial	
		[65]		Highliner		Not Highliner		[16]	
		\$ per trip	% of total trip cost	\$ per Trip	% of total trip cost	\$ per trip	% of total trip cost	\$ per trip	% of total trip cost
Boat fuel	Mean	146.80	62.3	178.75	70.9	154.51	62.5	105.00	53.5
	Standard error	13.3		32.98		18.51		19.84	
	Median	110.00		150.00		120.00		90.00	
Truck Fuel	Mean	23.27	9.9	16.08	6.4	26.43	10.7	21.38	10.9
	Standard error	2.49		3.08		3.83		4.03	
	Median	15.00		11.00		20.00		13.50	
Ice	Mean	23.22	9.9	26.25	10.4	25.46	10.3	15.75	8.0
	Standard error	2.10		5.00		2.52		4.77	
	Median	20.00		20.00		20.00		12.00	
Bait	Mean	17.38	7.4	15.42	6.1	14.89	6.0	7.75	4.0
	Standard error	5.20		8.19		3.75		2.62	
	Median	5.00		5.00		6.00		0.00	
Food and beverage	Mean	24.77	10.5	15.58	6.2	25.76	10.5	29.38	14.9
	Standard error	2.05		1.83		2.84		4.54	
	Median	20.00		12.50		20.00		25.00	
Total trip cost	Mean	235.44		252.08		247.05		196.13	
	Standard error	17.95		38.29		24.69		35.40	
	Median	190.00		206.50		195.00		143.50	

A number of surveys ($n = 31$) were completed at the 2011 Guam Marianas International Fishing Derby, held in August at two locations on Guam (Hagatna and Agat Harbors). A total of 76 boats participated in the 2-day tournament, equating to a 41% sample of tournament boats. These trip costs are considered separately from the estimates of pelagic trip costs presented in Table 42, as the expenditure patterns at tournaments are significantly different from everyday fishing behavior. The costs associated with fishing trips taken at the 2011 Guam Marianas International Fishing Derby averaged approximately \$455 with a median cost of \$320 (see Table 43), not including the \$200 boat entry fee. Relative to non-tournament fishing, it is clear that fishermen spent considerably more on boat fuel and food and beverage, clearly associated with more extended fishing effort and larger crew sizes.

Table 43.--Most recent TOURNAMENT *pelagic* fishing trip costs, by classification: means, standard errors, and medians.

Variable [n]		Full Sample [31]		Sell Fish [22]		Noncommercial [9]	
		\$ per trip	% of total trip cost	\$ per trip	% of total trip cost	\$ per trip	% of total trip cost
Boat fuel	Mean	309.90	68.2	285.32	68.1	370.00	68.3
	Standard error	35.56		42.16		65.55	
	Median	220.00		205.00		300.00	
Truck fuel	Mean	41.77	9.2	38.50	9.2	49.77	9.2
	Standard error	5.60		6.62		10.61	
	Median	30.00		27.50		45.00	
Ice	Mean	31.03	6.8	32.36	7.7	27.78	5.1
	Standard error	4.60		6.23		4.72	
	Median	25.00		23.00		30.00	
Bait	Mean	11.87	2.6	14.00	3.4	6.67	1.2
	Standard error	4.61		6.25		4.41	
	Median	0.00		0.00		0.00	
Food and beverage	Mean	60.00	13.2	48.64	11.6	87.78	16.2
	Standard error	12.10		13.56		24.02	
	Median	40.00		30.00		50.00	
Total trip cost	Mean	454.58		418.81		542.00	
	Standard error	51.12		61.49		90.26	
	Median	320.00		293.00		470.00	

For bottomfish fishing trips taken in 2010 and 2011, the average trip cost approximately \$197 with a median cost of \$170 (see Table 44). Fuel expenses were the largest contributor to total trip expenditures, although considering that bottomfish fishing is less fuel intensive than pelagic trolling, it comprised a smaller share of total trip costs relative to pelagic fishing. The average bottomfish fishing trip expenditures included \$110 for boat fuel and \$23 for truck fuel, leading fuel costs to account for a majority (67%) of total trip expenditures. Food and beverage was the next largest contributor to total trip costs at \$24 (12%), followed by ice (12%) and bait/tackle (9%). On average, noncommercial fishermen spent a larger percentage on food and beverage, relative to fishermen who sell a portion of their catch.

Table 44.--Most recent bottomfish trip costs, by classification: means, standard errors, and medians.

Variable [n]		Full Sample		Sell Fish				Noncommercial	
		[61]		Highliner		Not Highliner		[18]	
		\$ per trip	% of total trip cost	\$ per trip	% of total trip cost	\$ per trip	% of total trip cost	\$ per trip	% of total trip cost
Boat fuel	Mean	109.70	55.8	119.63	62.2	121.00	55.9	83.33	52.5
	Standard error	10.58		37.90		15.33		10.17	
	Median	100.00		88.50		100.00		77.50	
Truck fuel	Mean	23.07	11.7	16.63	8.6	23.60	10.9	25.89	16.2
	Standard error	2.39		3.89		2.89		5.67	
	Median	20.00		13.50		20.00		15.00	
Ice	Mean	22.87	11.6	24.50	12.7	24.26	11.2	19.44	12.1
	Standard error	2.14		8.00		2.35		4.58	
	Median	20.00		17.50		20.00		14.50	
Bait	Mean	17.26	8.8	14.75	7.7	21.77	10.1	9.61	5.9
	Standard error	3.10		4.34		5.00		2.89	
	Median	10.00		11.50		20.00		4.50	
Food and beverage	Mean	23.79	12.1	16.88	8.8	25.80	11.9	22.94	14.3
	Standard error	1.60		2.45		1.94		3.64	
	Median	20.00		16.50		20.00		20.00	
Total trip cost	Mean	196.69		192.38		216.43		160.22	
	Standard error	15.07		46.55		22.22		16.65	
	Median	170.00		159.00		180.00		135.00	

For reef fishing trips taken in 2010 and 2011, the average trip cost approximately \$116 with a median cost of \$85 (see Table 45). Fuel expenses were the largest contributor to total trip expenditures and had a share similar to pelagic fishing. The average reef fishing trip expenditures included \$63 for boat fuel and \$21 for truck fuel, leading fuel costs to account for a majority (72%) of total trip expenditures. Food and beverage was the next largest contributor to total trip costs at \$14 (12%), followed by ice (12%) and bait/tackle (4%). As with other trip types, on average, noncommercial fishermen spent a larger percentage on food and beverage, relative to fishermen who reported the sale of fish.

Table 45.--Most recent reef fish trip costs, by classification: means, standard errors, and medians.

Variable [n]		Full Sample [20]		Sell Fish [13]		Noncommercial [7]	
		\$ per trip	% of total trip cost	\$ per trip	% of total trip cost	\$ per trip	% of total trip cost
Boat fuel	Mean	63.20	54.4	65.31	55.8	59.29	51.5
	Standard error	13.56		20.17		12.17	
	Median	40.00		40.00		75.00	
Truck fuel	Mean	20.95	18.0	21.69	18.6	19.57	17.0
	Standard error	2.66		3.65		3.74	
	Median	20.00		20.00		20.00	
Ice	Mean	13.50	11.6	13.31	11.4	13.86	12.0
	Standard error	1.80		2.21		3.36	
	Median	10.00		10.00		12.00	
Bait	Mean	4.50	3.9	3.85	3.3	5.71	4.9
	Standard error	1.81		2.34		2.97	
	Median	0.00		0.00		0.00	
Food and beverage	Mean	14.10	12.1	12.69	10.9	16.71	14.5
	Standard error	2.00		2.25		3.97	
	Median	12.00		10.00		15.00	
Total trip cost	Mean	116.25		116.85		115.14	
	Standard error	18.39		26.74		20.09	
	Median	85.00		80.00		130.00	

Using data from the Guam DAWR creel surveys, during 2010-2011, it is estimated that Guam small boat fishermen took an average of approximately 15,143 boat fishing trips per year (WPacFIN, 2012). The majority of trips were pelagic trips (64%) followed by bottomfish (22%), reef fish (9%) and other gear types (5%). Using trip cost measures from the survey sample we estimate the annual direct sales impact from trip-related expenses during 2010-2011 to range from approximately \$2.6 million (using median trip costs) to \$3.3 million (using mean trip costs) (Table 46).

The aggregate number of trips reported for fishermen in our sample was approximately 6660 trips, nearly 44% of total estimated annual boat fishing trips (averaged between 2010 and 2011). Considering classification and trip type we estimate total trip-related expenditures for our survey sample to range from \$0.98 million (using median trip costs) to \$1.23 million (using mean trip costs).

Table 46.--Direct economic impact, trip-related expenditures (dollars).

	Total Trips	Median Estimate (\$)	Mean Estimate (\$)
2010	17,371 ^a	3,014,690	3,702,613
2011	12,918 ^a	2,278,035	2,798,399
Average, 2010-2011	15,143 ^a	2,646,363	3,250,506
Survey Response	6660	983,834	1,231,769

^aSource: WPacFIN, 2012.

Annual Fishing Expenditures

In addition to variable trip costs, fishing requires significant annual fixed-cost expenditures. A detailed accounting of annual expenditures as reported by survey respondents is presented in Table 47. This table presents fleet-level averages for major expenditure categories and also reports the prevalence each expenditure category noted in the table. Nearly every survey respondent (94%) reported to incur some non-trip-related fishing expenditure during 2010. The categories with the highest percentage of fishermen reporting expenditures were fishing gear (88%), oil and lube (84%), repair and maintenance (81%), fees (77%), and safety equipment (66%). Repair and maintenance was the category with the highest average expenditure in 2010, followed by gear expenditures. For the remainder of expenditure categories, the majority of fishermen reported no expenditures during 2010. On average, survey respondents reported approximately \$6275 in fishing-related expenditures with a median expenditure of \$3478. Fishery highliners incurred higher levels of expenditures with an average of \$12,030 and a median expenditure of \$10,100. As annual fishing expenditures can vary dramatically, it is advised that one considers median expenditures when considering differences among subgroups in the fishery. For a more accurate accounting of true “out-of-pocket” expenditures, see Table 48 which presents average expenditures limited to fishermen reporting nonzero expenditures for each category.

Nonresponse to the expenditure section (22%) was higher than one would hope for and proved far more problematic than any other section of the survey. While approximately 11% ($n = 11$) of boat owners left the expenditure section blank, the bulk of missing expenditure survey respondents were not boat owners. Nearly 46% ($n = 22$) of non-boat owners did not complete the expenditure section. Additionally, of those completing the expenditure section, 24% ($n = 6$) reported zero fishing related expenditures in 2010, so it is likely that a portion of those not completing the section could very well have simply not had fishing related expenditures during 2010.

The top expenditure categories for non-boat owners matched those of the full sample as the categories with the highest percentage of non-boat owner fishermen reporting expenditures were fishing gear (72%), oil and lube (44%), repair and maintenance (44%), fees (40%), and safety equipment (32%). Fishing gear (\$1539) was the category with the highest average expenditure in 2010 for non-boat owners, followed by repair and maintenance (\$731). For the remainder of expenditure categories, the majority of non-boat-owner fishermen reported no expenditures during 2010. All expenditure categories were significantly lower for non-boat owners relative to boat owners, as one would expect. The average annual fishing related expenditures in 2010 for non-boat owners was approximately \$2372 (median = \$600), compared to \$7372 for boat owners (median = \$4270).

Table 47.--Annual fishing expenditures in 2010 (including zero expenditure responses): means, standard errors, and medians.

Variable [n]	% of fleet with expenditure			Sell Fish		Noncommercial [35]
			Full Sample [114]	Highliner [14]	Not Highliner [65]	
Boat insurance	16.5	Mean	173	150	219	95
		Standard error	51	129	77	66
		Median	0	0	0	0
Loan payments on the boat	19.1	Mean	736	1557	944	23
		Standard error	230	635	373	18
		Median	0	0	0	0
Financial svcs.: bookkpng/acctg	6.1	Mean	21	21	32	0
		Standard error	14	21	23	0
		Median	0	0	0	0
Moorage fees	18.3	Mean	293	867	192	250
		Standard error	89	585	65	121
		Median	0	0	0	0
Repair, maint. for vessel, engs, or trailer	80.9	Mean	2688	6185	2088	2403
		Standard error	617	3475	441	1198
		Median	525	1900	800	400
Oil and lube	83.5	Mean	235	539	210	160
		Standard error	42	281	36	38
		Median	100	200	120	100
Gear	87.8	Mean	1270	2125	1295	881
		Standard error	187	657	263	239
		Median	500	1000	500	500
Electronics	53.9	Mean	488	314	594	360
		Standard error	77	102	103	154
		Median	150	150	250	0
Fees	76.5	Mean	164	134	179	149
		Standard error	19	36	25	39
		Median	100	100	120	60
Safety equipment	66.1	Mean	163	100	185	147
		Standard error	20	26	26	41
		Median	100	125	120	0
Other	3.5	Mean	45	36	71	0
		Standard error	28	36	49	0
		Median	0	0	0	0
Annual fishing expenditures in 2010	93.9	Mean	6275	12,030	6009	4469
		Standard error	829	3514	831	1628
		Median	3478	10,100	3780	1300

Table 48.--Annual fishing expenditures in 2010 (excluding zero expenditure responses): means, standard errors, and medians.

Variable [n]		Full Sample	Sell Fish		Noncommercial
			Highliner	Not Highliner	
Boat insurance		[18]	[2]	[12]	[4]
	Mean	1093		1188	831
	Standard error	222	n/a	288	472
Loan payments on the boat	Median	900		1025	575
		[23]	[6]	[14]	[3]
	Mean	3963	3633	4896	269
Financial svcs.: bookkpng/acctg	Standard error	926	969	1390	174
	Median	3600	3700	3900	190
		[7]	[1]	[6]	[0]
Moorage fees	Mean	342		349	
	Standard error	196	n/a	232	n/a
	Median	100		100	
Repair, maint. for vessel, engs, or trailer		[21]	[3]	[14]	[4]
	Mean	1668	4048	1009	2190
	Standard error	369	1991	220	212
Oil and lube	Median	1644	2500	650	2330
		[95]	[11]	[62]	[22]
	Mean	3911	7873	3239	3824
Gear	Standard error	941	4319	1037	1854
	Median	1000	5000	1000	1000
		[96]	[11]	[59]	[26]
Electronics	Mean	300	685	265	216
	Standard error	52	347	49	46
	Median	165	300	150	123
Fees		[101]	[12]	[64]	[25]
	Mean	1453	2479	1346	1234
	Standard error	205	717	266	309
Safety equipment	Median	500	1500	500	500
		[62]	[7]	[41]	[14]
	Mean	913	629	966	900
Other	Standard error	118	111	136	344
	Median	500	500	700	375
		[88]	[11]	[55]	[22]
Other	Mean	213	171	211	237
	Standard error	22	39	27	55
	Median	150	200	150	125
Other		[76]	[8]	[51]	[17]
	Mean	258	175	256	302
	Standard error	26	16	32	67
Other	Median	200	175	200	200
		[4]	[1]	[3]	[0]
	Mean	1275		1533	
Other	Standard error	578	n/a	731	n/a
	Median	1250		2000	

In an effort to understand how much of these fishing-related expenditures stay on Guam and contribute to the local economy, we asked fishermen what percentage of these expenditures were purchased off-island, either in person, online, or through a mail-order catalog. While 21% of fishermen reported that *all* fishing related expenditures were local, the majority (79%) reported to make off-island purchases during 2010. It would appear that about half of the reported non-trip-related fishing expenditures (49%) can be directly linked to the Guam economy, as on average approximately 51% of expenditures is attributed to off-island sources. The average percentage of off-island expenditures for subgroups of the fishery is presented in Table 49.

Table 49.--Survey Responses: “What percentage of these expenditures was purchased off-island?”

Percentage of Expenditures [n]	Mean (%)	St. Error	Median
Full Sample [113]	51.2	3.4	50.0
<i>GFCMA Membership</i>			
Yes [61]	50.7	4.2	50.0
No [52]	51.8	5.4	50.0
<i>Sell Fish</i>			
Yes [77]	55.6	3.8	60.0
Highliner [13]	59.2	10.0	50.0
Not highliner [64]	54.9	4.1	60.0
No [36]	41.9	6.7	37.5
<i>Primary Target</i>			
Pelagic [72]	53.4	4.1	50.0
Bottomfish [15]	50.0	9.8	50.0
Reef fish [8]	46.9	12.9	50.0
No primary [18]	45.3	9.3	45.0
<i>Boat Ownership</i>			
Yes [86]	52.4	3.8	50.0
No [27]	47.6	7.2	50.0

The aggregate fishing expenditures reported in the past 12 months for fishermen in our sample was approximately \$0.88 million. Considering off-island purchases, our survey sample reported approximately \$0.43 million of durable good fishing expenditures that can be directly attributed to the Guam economy (Table 50).

Based on activity estimates from the Guam DAWR creel surveys, during 2010-2011, it is estimated that between 393 and 535 boats were active on Guam (Tibbatts and Flores, 2012). If one were to assume the survey sample was representative of the Guam small boat population, using estimates from our survey sample, annual durable good expenditures in 2010 would range from approximately \$2.48 million (using median expenditure estimates) to \$5.50 million (using mean expenditure estimates) for the Guam small boat fishery. Based on these estimates, between \$1.21 million (using medians) and \$2.69 million (using means) can be directly attributed to the local island economy (see Table 50).

Table 50.--Direct economic sales impact, durable good expenditures (dollars)

	Number of Active Vessels/ Fishermen	Median Total Expenditures	Mean Total Expenditures	Guam Expenditures ^c (median)	Guam Expenditures (mean)
Boat owners ^a	Low estimate (<i>n</i> = 393)	1,678,110	2,897,196	822,274	1,419,626
	Average estimate (<i>n</i> = 454)	1,938,580	3,346,888	949,904	1,639,975
	High Estimate (<i>n</i> = 560)	2,391,200	4,128,320	1,171,688	2,022,877
Non- boat owners ^b	Low estimate (<i>n</i> = 786)	471,600	1,867,536	231,084	915,093
	Average estimate (<i>n</i> = 908)	544,800	2,157,408	266,952	1,057,130
	High Estimate (<i>n</i> = 1120)	672,000	2,661,120	329,280	1,303,949
TOTAL	Low estimate (<i>n</i> = 1179)	2,149,710	4,764,732	1,053,358	2,334,719
	Average estimate (<i>n</i> = 1362)	2,483,380	5,504,296	1,216,856	2,697,105
	High Estimate (<i>n</i> = 1680)	3,063,200	6,789,440	1,500,968	3,326,826
Survey Response	<i>N</i> = 147	\$878,095		\$430,267	

^aSource: WPacFIN, 2012.^bUsing the median crew size reported in our survey, we assume the non-boat owner population to be twice the boat owner population.^cUsing the average percentage of purchases made on the island of Guam (49%)

Levels of Investment

In the survey, Guam fishermen detailed the significant levels of investment they have made in fishing. The average vessel in the fleet cost approximately \$24,503 when purchased (see Table 51). On average, as a result of the slightly larger vessel size as presented in Table 11, fishery highliners' vessel purchase cost is greater than other participants in the fleet. Nearly 74% of vessels were purchased used and, on average, approximately 41% required financing. Average loan amounts were similar across subgroups of the fleet, with fishery highliners reporting slightly lower loan amounts.

Table 51.--Vessel purchase characteristics: means, standard errors, and medians.

Variable [n]		Full Sample [91]	Highliner [12]	Sell Fish Not Highliner [59]	Noncommercial [20]
Boat cost (in dollars)	Mean	24,503	31,758	23,851	22,075
	Standard error	3108	8617	4177	4820
	Median	15,000	20,000	16,000	14,500
Purchased new/ used (%)	New	26.0	25.0	27.7	21.7
	Used	74.0	75.0	72.3	78.3
Purchased financed? (%)	Cash only	59.1	41.7	60.0	66.7
	Cash and loan	26.9	41.7	25.0	23.8
	Loan only	14.0	16.6	15.0	9.5
Original loan amount (in dollars)		[33]	[5]	[21]	[7]
	Mean	19,712	14,000	20,880	20,285
	Standard error	2412	4324	3090	6108
	Median	15,000	12,000	20,000	15,000

To better understand the overall investment that Guam fishermen currently have in fishing, they were asked to estimate a current market value of the electronics and gear that they currently use (considering age and condition). Likewise, fishermen were asked to estimate a current market value for their boat (considering age and condition, including trailer, if applicable). On average, the current value of electronics currently used for fishing on Guam is approximately \$6928 (with a median of \$2500). Average investment in fishing gear was rather consistent across subgroups of the fishery (see Table 52). Many estimated the market value of their vessel to be similar to, if not slightly higher than, the purchase price in nominal terms; this is largely based on investments and improvements of the vessel and motors over time.

Table 52.--Levels of investment (in dollars): means, standard error, minimums and maximums.

Variable [n]		Full sample [83]	Highliner [8]	Sell Fish Not Highliner [55]	Noncommercial [20]
Market value, electronics	Mean	6928	2694	8062	5505
	Standard error	1239	1173	1720	1880
	Median	2500	1500	2800	2250
Market value, gear	Mean	6170	7000	6431	5120
	Standard error	596	1363	742	1305
	Median	5000	6000	5000	4000
Market value, boat (including motor(s) and trailer)	Mean	29,328	46,250	29,221	22,850
	Standard error	3408	11,755	4463	4872
	Median	20,000	40,000	20,000	13,500

Fishermen were asked to describe when they last upgraded their fishing electronics to better understand the role of technology in fishing operations. Only about 28% of the fleet had upgraded their fishing electronics within the past year, whereas the remainder of survey respondents was split between 1 and 3 years ago (42%) and more than 3 years ago (30%).

Crew Considerations

As noted earlier in the vessel characteristics section, a number of fishermen completing the survey (approximately 31%) identified themselves as non-boat owners. While not the captain on fishing trips, crew fishermen are often an integral part of fishing operations. We found that 58% of crew fishermen indicated that they always fish on the same boat with the same captain.

Fishermen were asked about compensation arrangements for their time and assistance and found a diversity of responses across the fleet. A majority of crew fishermen (54%) reported that they receive no compensation for their time as crew members, many of which indicated that they were family or friends who simply enjoyed fishing. Additionally, 14% reported that they contribute a portion of trip costs in exchange for the fishing opportunity. According to crew survey respondents who receive compensation, approximately 67% reported that they keep a percentage of total fish caught on a trip with the mean percentage being 36%. Nearly 10% reported that they keep all the fish they catch on a trip. For crew members involved in trips where fish are sold, 19% reported that they receive a share of trip revenues (an average of 40%). An additional 22% stated that compensation varied from trip to trip.

Social Aspects of Fishing

This section describes important social and cultural considerations that are useful in understanding the underlying motivations and behavior of Guam small boat fishermen. This section describes catch disposition, social networks, social standing, food security, and issues related to fisher classification.

Catch Disposition

The ultimate disposition of catch from Guam fishermen reflects the diverse social, cultural, and economic motivations towards fishing. Approximately 29% of fish catch was reported to be consumed at home, while 35% was given away to relatives, friends, or crew with approximately 34% of fish sold, in the past 12 months. The remaining catch is either released (2%) or exchanged for goods and services (3%). This diversity of catch extends across all subgroups of the fishery including fishery highliners who, despite their avid market participation, still retain approximately 30% of the fish they catch for home consumption and participation in traditional fish-sharing networks and customary exchange (Table 56).

In general, we find that fishermen targeting pelagic fish are more likely to sell higher levels of their catch, and GFCA members take advantage of the market opportunities afforded by the Guam Fishermen's Cooperative Association, with cost recovery as a driving motivation. The significant percentage of fish caught for home consumption and for distribution to relatives and friends reflects the strong family and social connections associated with fishing on Guam. These findings validate the importance of fishing in terms of building and maintaining social and community networks, perpetuating fishing traditions, and providing fish to local communities as a source of food security.

Table 56.--Survey Responses: "In the past 12 months, what percentage of your catch was..."

Percentage of Responses [n]	Catch and Release (%)	Consumed at Home (%)	Given to relatives (%)	Given to Friends/ Neighbors (%)	Given to Crew (%)	Fiestas/ Cultural Event (%)	Exchanged for goods/ services (%)	Sold (%)
Full Sample [147]	2.1	28.9	13.3	9.2	12.3	7.3	2.6	24.3
<i>GFCA Membership</i>								
Yes [77]	2.3	23.4	11.5	7.8	12.3	6.9	2.5	33.3
No [70]	2.1	34.9	15.2	10.8	12.2	7.7	2.6	14.5
<i>Sell Fish</i>								
Yes [102]	2.1	20.9	11.6	8.3	10.6	8.1	3.3	35.1
Highliner [15]	0.7	7.3	5.8	3.3	5.1	8.3	0.3	69.2
Not highliner [87]	2.4	23.3	12.6	9.1	11.5	8.0	3.8	29.3
No [45]	2.2	47.0	17.0	11.4	16.0	5.5	0.9	0.0
<i>Primary Target</i>								
Pelagics [91]	2.0	24.5	11.2	8.1	13.0	8.9	2.1	30.2
Bottomfish [20]	1.6	37.9	12.6	11.9	11.3	6.0	2.8	15.9
Reef fish [13]	2.2	41.7	22.4	8.9	7.3	2.9	6.5	8.1
No primary [23]	3.4	31.3	16.8	11.2	12.9	4.7	2.2	17.5
<i>Boat Ownership</i>								
Yes [101]	2.3	27.6	12.4	8.5	13.0	6.6	2.0	27.6
No [46]	2.0	31.7	15.2	10.7	10.5	8.9	3.8	17.2

Social Networks

In addition to the social aspects of catch disposition, there are strong social networks amongst the fishing community on Guam. Fishing on Guam is by nature a social activity as only 7% of fishermen reported to fish alone, and 45% reported that their boat is used without them on occasion (Table 12). In addition, the majority of fishermen responding to our survey (61%) reported to be a member of a fishing club, association or group. With that said, only 10% of non-GFCA members reported to be a member of a fishing organization on Guam. We find that a majority of fishermen who sell fish (77%) are active in these social networks, while 26% of noncommercial fishermen reported associations. Fishing organization membership varies by primary target, as pelagic fishermen (69%) were more likely to be a part of a fishing group than bottomfish fishermen (41%) and reef fish fishermen (36%). Boat owners (70%) also reported more activity in organizations relative to non-boat owners (36%). The diversity of fishing

groups and organizations and the distribution of membership amongst survey respondents is presented in Table 57.

Table 57.--Survey Responses: “Are you a member of a fishing club/association or group?”

Percentage of Responses [n]	GFCA (%)	GOSA (%)	MUFF (%)	MASC (%)	SFA (%)	Other (%)	Multiple (%)
Full Sample [137]	56.2	1.5	8.8	0.7	1.5	2.9	10.2
<i>GFCA Membership</i>							
Yes [77]	100.0	2.6	11.7	0.0	1.3	3.9	18.2
No [60]	0.0	0.0	5.0	1.7	1.7	1.7	0.0
<i>Sell Fish</i>							
Yes [94]	72.3	2.1	11.7	1.1	1.1	2.1	12.8
Highliner [14]	78.6	7.1	28.6	0.0	0.0	0.0	35.7
Not highliner [80]	71.3	1.3	8.8	1.3	1.3	2.5	8.8
No [43]	20.9	0.0	2.3	0.0	2.3	4.7	4.7
<i>Primary Target</i>							
Pelagics [86]	66.3	1.1	3.5	0.0	2.3	3.5	8.1
Bottomfish [17]	41.2	0.0	5.9	0.0	0.0	0.0	5.9
Reef fish [11]	27.3	0.0	18.2	9.1	0.0	9.1	27.3
No primary [23]	43.5	4.4	26.1	0.0	0.0	0.0	13.0
<i>Boat Ownership</i>							
Yes [98]	66.3	2.0	10.2	1.0	2.0	3.1	13.3
No [39]	30.8	0.0	5.1	0.0	0.0	2.6	2.6

GFCA: Guam Fishermen’s Cooperative Association [GUAM]

GOSA: Guam Organization of Saltwater Anglers [GUAM]

MUFF: Marianas Underwater Fishing Federation [GUAM]

MASC: Marianas Apnea Spearfishing Club [MARIANAS]

SFA: Saipan Fishermen Association [CNMI]

OTH: Other fishing group

Social Standing

The results presented thus far confirm that fishing is an integral part of the culture on Guam. We asked fishermen to consider their relationship to the non-fishing community to better understand their perception of social standing. The majority of fishermen (60%) agreed that as a fisherman, they are respected by the Guam community. While nearly a third of respondents were neutral and some were hesitant to express an opinion or simply did not know, we found that very few felt that they were not respected by the community which validates the social and cultural importance of fishing practices and traditions (Table 58).

Table 58.--Survey Responses: “As a fisherman, I am respected by the community”

Percentage of Responses [n]	Strongly Agree (%)	Somewhat Agree (%)	Neutral (%)	Somewhat Disagree (%)	Strongly Disagree (%)	Don't Know (%)
Full Sample [143]	36.4	23.1	25.2	2.8	1.4	11.2
<i>GFCAMembership</i>						
Yes [75]	30.8	33.3	25.3	1.3	1.3	8.0
No [68]	42.6	11.8	25.0	4.4	1.5	14.7
<i>Sell Fish</i>						
Yes [98]	33.7	26.5	25.5	1.0	2.1	11.2
Highliner [15]	33.3	33.3	6.7	6.7	0.0	20.0
Not highliner [83]	33.7	25.3	28.9	0.0	2.4	9.6
No [45]	42.2	15.6	24.4	6.7	0.0	11.1
<i>Primary Target</i>						
Pelagics [90]	30.0	26.7	27.8	1.1	1.1	13.3
Bottomfish [19]	47.4	26.3	10.5	5.3	0.0	10.5
Reef fish [12]	50.0	16.7	25.0	0.0	0.0	8.3
No primary [22]	45.5	9.1	27.2	9.1	0.0	9.1
<i>Boat Ownership</i>						
Yes [98]	35.7	26.5	26.5	2.0	1.0	8.2
No [45]	37.8	15.6	22.2	4.4	2.2	17.8

Food Security

In addition to the social importance evident in the disposition of Guam small boat catch, a majority of fishermen consider the fish they catch to be an important source of food for their families (see Table 59). Nearly 77% of our survey respondents attested to the importance of pelagic fish for family consumption, and these perceptions strengthen when one considers bottomfish (79%) and reef fish (85%). We find little variation across subgroups of the fishery, with perhaps an exception being the relationship of fishery highliners and bottomfish. This relationship likely demonstrates the economic importance of high-valued deep bottomfish as 57% of commercial highliners reported that bottomfish were an important source of food. These results clearly demonstrated that fish caught on Guam are an important source of food security for fishermen and local communities.

Table 59.--Survey Responses: “Are the fish you catch an important source of food for your family?”

Percentage of Respondents ^a [n]	<i>Pelagics</i>	<i>Bottomfish</i>	<i>Reef Fish</i>
Full Sample [139]	77.7	78.7	85.1
<i>GFCA Membership</i>			
Yes [77]	76.6	73.5	81.8
No [62]	79.0	84.8	88.5
<i>Sell Fish</i>			
Yes [99]	79.8	78.9	86.5
Highliner [15]	73.3	57.1	80.0
Not highliner [84]	80.9	82.9	87.5
No [40]	72.5	78.4	81.8
<i>Primary Target</i>			
Pelagics [90]	73.3	72.7	81.9
Bottomfish [18]	88.9	94.7	92.3
Reef fish [9]	100.0	88.9	100.0
No primary [22]	77.3	81.8	80.9
<i>Boat Ownership</i>			
Yes [97]	76.3	77.3	85.1
No [42]	80.9	82.1	85.0

^aLimited to fishermen reporting catch of each species group.

Fisher Classification

An inherent difficulty in the future management of this and other small boat fisheries in the western Pacific region is that of fisher classification. While the Magnuson-Stevens Fishery Conservation and Management Act (MSA) has clear legal definitions of commercial fishing, these regulatory definitions do not consider cultural motivations towards fishing in the western Pacific and are not adequate to properly describe fishing behavior, attitudes, and perceptions. Research has shown that fisher perceptions do not align well with regulatory frameworks in many western Pacific small boat fisheries (Hospital and Beavers, 2012; Hospital, et al., 2011; Hamilton, 1998).

To help improve our understanding of this, we first asked fishermen to define what “commercial” fishing meant to them. Fishermen were presented with a menu of options, including behavior that would meet federal definitions, and a variety of scales of market participation. We allowed fishermen to choose any and all responses that they felt applied to define a fisherman as commercial. As shown in Table 60, the highest responses were associated with selling 50% of catch (35%), achieving 50% of one’s personal income from fishing (32%) and selling *all* catch (30%). However, there was less agreement on legally established definitions. For instance, the MSA defines “commercial” fishing to encompass any fish entering commerce, whereas only 5% of fishermen considered selling one fish to be commercial fishing. The majority of fishermen (64%) only chose one response to this question and 25% of these fishermen agreed that if one sells 50% of their catch they should be considered a commercial fisherman. An additional 13% felt that all personal income should come from fishing to be considered a commercial fisherman. In

general, fishermen related commercial fishing more to reliance on fish catch as a source of personal income than to the share of fish caught that is sold.

Table 60.--Survey Responses: "How would you define a fisherman as commercial (check all that apply)?"

Percentage of Responses [n]	Sell at least one fish	Sell 25% of catch	Sell 50% of catch	Sell <u>all</u> catch	25% personal income	50% personal income	All personal income
Full Sample [143]	4.9	6.3	35.2	30.1	13.3	31.5	26.1
<i>GFCA Membership</i>							
Yes [76]	2.6	6.6	32.0	34.2	15.8	27.6	30.3
No [67]	7.5	6.0	38.8	25.4	10.5	35.8	21.2
<i>Sell Fish</i>							
Yes [102]	2.9	5.9	36.6	29.4	13.7	28.4	27.5
Highliner [15]	0.0	6.7	33.3	40.0	20.0	6.7	40.0
Not highliner [87]	3.5	5.8	37.2	27.6	12.6	32.2	25.3
No [41]	9.8	7.3	31.7	31.7	12.2	39.0	22.5
<i>Primary Target</i>							
Pelagics [91]	3.3	6.6	31.9	32.9	17.6	29.7	27.5
Bottomfish [19]	5.3	10.5	31.6	26.3	5.3	42.1	27.8
Reef fish [11]	0.0	9.1	45.5	36.4	0.0	36.4	18.2
No primary [22]	13.6	0.0	47.6	18.2	9.1	27.3	22.7
<i>Boat Ownership</i>							
Yes [100]	5.0	7.0	31.3	29.0	13.0	29.0	30.3
No [43]	4.7	4.7	44.2	32.6	13.9	37.2	16.3

After asking fishermen to define commercial fishing, we followed up by asking fishermen to self-classify themselves. As mentioned in the market participation and access section, nearly 70% of fishermen reporting to our survey reported to have sold fish in the past 12 months. Of these, approximately 52% reported to have sold 25% or less of their fish catch in the past 12 months, and 32% reported to have sold more than 50% of their catch.

The highest association was with recreational expense (44%) followed by subsistence (36%) and cultural (31%). Recreational expense was defined as, "I fish primarily for sport or pleasure, but I also sell a few fish to recover trip expenses." Therefore it is clear that economic motivations, outside of recovering trip expenses, are not prevalent among Guam small boat fishermen as only 17% reported commercial motivations. The difficulty of categorizing fishing activity on Guam is also evident from the high percentage of fishermen who chose multiple responses to this question. Nearly 40% of respondents provided multiple classifications to define themselves. The distribution of self-classification by subgroups of the fishery is presented in Table 61.

Table 61.--Survey Responses: “How would you define yourself as a fisherman?
(check all that apply)”^a

Percentage of Responses [n]	Full-Time Commercial	Part-Time Commercial	Cultural	Subsistence	Recreational Expense	Purely Recreational	Multiple Motivations
Full Sample [147]	3.4	14.3	30.6	36.1	44.2	30.6	39.5
<i>GFCA Membership</i>							
Yes [78]	5.1	21.8	29.5	29.5	50.0	28.2	41.0
No [68]	1.5	5.9	32.4	44.1	38.2	32.4	38.2
<i>Sell Fish</i>							
Yes [102]	4.9	18.6	35.3	32.3	57.9	19.6	42.2
Highliner [15]	13.3	33.3	26.7	33.3	53.3	6.7	33.3
Not highliner [87]	3.5	16.1	36.8	32.2	58.6	21.8	43.7
No [44]	0.0	4.4	20.0	44.4	13.3	55.6	33.3
<i>Primary Target</i>							
Pelagics [91]	5.5	12.1	28.6	36.3	48.4	28.6	37.4
Bottomfish [20]	0.0	20.0	35.0	35.0	40.0	30.0	50.0
Reef fish [13]	0.0	7.7	38.5	46.2	30.8	46.2	53.9
No primary [23]	0.0	21.7	30.4	30.4	39.1	30.4	30.4
<i>Boat Ownership</i>							
Yes [101]	3.9	17.8	28.7	25.7	51.5	30.7	39.6
No [45]	2.2	6.5	34.8	58.7	28.3	30.4	39.1

^aDoes not sum to 100% because fishermen were allowed to indicate multiple classifications.

Fisher Perceptions

The survey also made efforts to elicit some attitudes and perceptions from Guam’s small boat fishermen. This section will detail the results of these questions including perceptions of recent fishing conditions and participation, expectations for the Marianas Trench Marine National Monument, attitudes towards marine preserve areas (MPAs), and impacts of military exercises in the region.

Fishing Conditions and Participation

We asked fishermen their perceptions of fishing conditions in recent years in the context of catchability. A majority of fishermen feel that it has become harder to catch pelagic (82%) and reef fish (73%) in recent years, while a slightly lower share of fishermen feel similarly about bottomfish (53%). Nearly 36% of fishermen reported that all species groups have become harder to catch in the last 5 years. There were few differences across subgroups in the fishery. The distribution of responses is presented in Table 62.

Table 62.--Survey Responses: “In the last five (5) years, do you believe it has become easier, harder, or about the same to catch...”

Percentage of “YES” Respondents ^a [n]	<i>Pelagics</i>			<i>Bottomfish</i>			<i>Reef Fish</i>		
	<i>Easier</i>	<i>Same</i>	<i>Harder</i>	<i>Easier</i>	<i>Same</i>	<i>Harder</i>	<i>Easier</i>	<i>Same</i>	<i>Harder</i>
Full Sample [136]	3.7	14.7	81.6	8.9	38.2	52.9	3.9	22.8	73.3
<i>GFCA Membership</i>									
Yes [74]	4.1	16.2	79.7	12.5	42.2	45.3	3.9	23.5	72.6
No [62]	3.2	12.9	83.9	5.1	33.9	61.0	4.0	22.0	74.0
<i>Sell Fish</i>									
Yes [94]	4.3	17.0	78.7	12.2	40.2	47.6	5.9	23.9	70.2
Highliner [15]	6.7	20.0	73.3	16.6	41.7	41.7	11.1	11.1	77.8
Not highliner [79]	3.8	16.5	79.8	11.4	40.0	48.6	5.2	25.9	68.9
No [42]	2.4	9.5	88.1	2.4	34.2	63.4	0.0	20.6	79.4
<i>Primary Target</i>									
Pelagics [89]	1.1	15.7	83.2	5.3	38.7	56.0	1.7	25.4	72.9
Bottomfish [16]	6.3	0.0	93.7	16.7	50.0	33.3	0.0	22.2	77.8
Reef fish [9]	11.1	22.2	66.7	0.0	37.5	62.5	0.0	16.7	83.3
No primary [22]	9.1	18.2	72.7	18.2	27.3	54.5	14.3	19.1	66.7
<i>Boat Ownership</i>									
Yes [95]	5.3	11.6	83.2	12.1	36.1	51.8	6.3	15.6	78.1
No [41]	0.0	21.9	78.1	2.5	42.5	55.0	0.0	35.1	64.9

^aLimited to fishermen reporting catch of each species group.

Survey respondents were given the chance to expand on their answers to this question with an open-ended prompt: “What has made it easier or harder to catch these fish?”, and nearly 73% of survey respondents left comments. These comments focused almost exclusively on why it has become *harder* to catch fish. The most repeated and succinct answer was a simply stated “Less fish, more fishermen.” Approximately 44% of comments allude to overfishing or depleted fish stocks, and 36% of these comments point more narrowly to large-scale commercial fishing, specifically to purse seiners and longliners as the source of the overfishing. An increase in effort from a growing number of fishermen was mentioned by approximately 19% of fishermen. Other trends were less frequent but included changes in weather and climate (12%), pollution and shore run-off as a potential threat to fishing grounds (7%), less areas for the public to fish due to closed areas (6%), the migration patterns of fish (6%), the rising cost of fuel (6%), and fewer FADs in place (5%). The sparse mention of ways in which fishing has been made easier focused primarily on the availability of better fishing gear and electronics.

Likewise, we asked fishermen regarding their perceptions of fishing participation in the coming year. Despite finding that, in general, fishermen report that it has become harder to catch fish in recent years, a majority of fishermen feel that more people will be involved in all types of fishing in the coming year (see Table 63). Although as suggested by the results of Table 62, fishermen feel most strongly that slightly more people will be involved in bottomfish fishing relative to other fish groups. There were few differences across subgroups in the fishery. The distribution of responses is presented in Table 63.

Table 63.--Survey Responses: “In the next year do you think *more* people will be involved in fishing?”

Percentage of “YES” Respondents ^a [n]	<i>Pelagics</i>	<i>Bottomfish</i>	<i>Reef Fish</i>
Full Sample [131]	69.5	80.6	74.6
<i>GFCA Membership</i>			
Yes [68]	63.2	78.3	72.6
No [63]	76.2	83.3	76.7
<i>Sell Fish</i>			
Yes [89]	65.2	78.9	74.7
Highliner [15]	60.0	64.3	71.4
Not highliner [84]	66.2	81.6	75.4
No [42]	78.6	84.6	74.4
<i>Primary Target</i>			
Pelagics [82]	65.9	73.2	65.8
Bottomfish [17]	82.4	94.1	88.2
Reef fish [11]	90.9	90.0	80.0
No primary [21]	61.9	95.0	94.7
<i>Boat Ownership</i>			
Yes [91]	68.1	79.1	70.7
No [40]	72.5	84.2	82.5

^a - Limited to fishermen reporting catch of each species group

In response to the open-ended question “Why do you feel this way?”, approximately 64% of respondents appended comments to their previous answers. The two most prevalent themes represented in these comments were that of a rising population and rising fuel costs. Many respondents (30%) noted that the expanding population on Guam, due in part to a military buildup, would increase the demand for fish and the number of people fishing. Conversely, 32% of responses indicated that they believed the number of fishermen would be restricted by rising fuel costs and economic considerations, especially in regard to pelagic trolling, which consumes considerably more fuel than either reef or bottomfish fishing. Several fishermen specifically stated that this was the reason they expect the number of pelagic fishermen to *decrease* but the number of reef and/or bottomfish fishermen to *increase*. Also prevalent in the comments were the themes that fishing as a recreational activity is becoming increasingly popular (12%), that fishing is way of life and important cultural activity in Guam (9%), and that fishing would increase due to a weak economy that necessitates more subsistence fishing (8%).

Marianas Marine National Monument and Closed Areas (MPAs)

On January 16, 2009, Presidential Proclamation 8335 declared the establishment of the Marianas Trench Marine National Monument. The Marianas Trench Marine National Monument (Monument) consists of three units: the Trench, Volcanic and Islands Units. The Trench and Volcanic Units include only the submerged lands within these areas. The Trench Unit is of most interest to Guam fishermen as it is located to the South and East of the island, approximately 50 nautical miles offshore, encompassing a total area of approximately 59,732 nm².

In our survey questionnaire because the establishment of the Monument was a contentious issue among the communities in the Marianas, when posed the question, “how familiar are you with the Marianas Trench Marine National Monument?”, the overwhelmingly majority (91%) of Guam fishermen reported to be at least somewhat familiar with the Monument (see Table 64). Fishery highliners reported the highest degree of familiarity, and noncommercial fishermen reported the most uncertainty.

Table 64.--Survey Responses: “How Familiar are you with the Marianas Trench Marine National Monument?”

Percentage of Responses [n]	Extremely Familiar (%)	Somewhat Familiar (%)	I have not heard of it (%)
Full Sample [141]	27.0	63.8	9.2
<i>GFCA Membership</i>			
Yes [74]	33.8	63.5	2.7
No [67]	19.4	64.2	16.4
<i>Sell Fish</i>			
Yes [98]	32.7	62.2	5.1
Highliner [15]	53.3	46.7	0.0
Not highliner [83]	28.9	65.1	6.0
No [43]	14.0	67.4	18.6
<i>Primary Target</i>			
Pelagics [89]	29.2	61.8	9.0
Bottomfish [18]	22.2	66.7	11.1
Reef fish [12]	25.0	58.3	16.7
No primary [22]	22.7	72.7	4.6

Aside from the intrinsic benefits of establishing marine monuments, a number of organizations supporting the establishment of the Monument touted numerous economic benefits associated with the Monument. While the benefits were largely attributed to the Commonwealth of the Northern Mariana Islands (CNMI), reports estimated the Monument could generate in excess of \$10 million in spending, over \$14 million in sales, almost \$5 million in tax revenues, and account for almost 400 jobs (Iverson, 2008). We asked fishermen about the perceived benefits from the Monument. The analysis of perceived benefits for the establishment of the Monument is somewhat confounded by the high levels of uncertainty and unfamiliarity with potential benefits, but a minority of Guam fishermen believe the Monument will benefit the local economy (21%) and even fewer (16%) feel that the closed area will improve catch rates for Guam fishermen.

Table 65.--Survey Responses: “Do you feel the Marianas Trench Marine National Monument will benefit...?”

Percentage of “YES” Respondents [n]	<i>The local economy</i>			<i>Your catch rates</i>		
	Yes	No	Don’t Know	Yes	No	Don’t Know
Full Sample [144]	21.5	41.0	37.5	15.5	42.9	41.6
<i>GFCMA Membership</i>						
Yes [76]	15.8	55.3	28.9	9.5	64.9	25.7
No [68]	27.9	25.0	47.1	22.1	19.1	58.8
<i>Sell Fish</i>						
Yes [99]	17.7	46.5	36.4	13.1	48.5	38.4
Highliner [15]	6.7	66.7	26.6	0.0	73.3	26.7
Not Highliner [84]	19.1	42.9	38.1	15.5	44.0	40.5
No [45]	31.1	28.9	40.0	20.9	30.2	48.9
<i>Primary Target</i>						
Pelagics [91]	22.0	37.4	40.6	12.2	43.3	44.5
Bottomfish [19]	21.1	42.1	36.8	22.2	38.9	38.9
Reef Fish [12]	41.7	33.3	25.0	25.0	41.7	33.3
No primary [22]	9.1	59.1	31.8	18.2	45.5	36.3
<i>Boat Ownership</i>						
Yes [99]	19.2	43.4	37.4	14.3	49.0	36.7
No [45]	26.7	35.6	37.7	18.2	29.5	52.3

A major concern for fishermen who have traditionally fished inshore is the loss of accessible fishing grounds caused by the establishment of five marine preserve areas (MPAs) in 1997. The five MPAs are: Tumon Bay, Piti Bomb Holes, Sasa Bay, Achang Reef Flat and Pati Point (Lucas, 2010). Boat fishing is prohibited in all MPAs. MPAs were established for the purpose of preserving local traditions and protecting the natural resource of fish (Guam Legislature, 1997). Fishermen have reported that MPAs have displaced them from their traditional fishing grounds and prevent them from teaching fishing techniques in a safe environment to the younger generation (Allen and Bartram, 2008).

Fishermen were asked to report on their perception of the effectiveness of existing MPAs in promoting sustainable nearshore fisheries. A majority of fishermen (61%) reported that MPAs have been at least somewhat effective, although we find slight differences across subgroups of the fishery, with fishermen reporting the sale of fish expressing less confidence in MPAs. The distribution of responses is presented in Table 66.

Table 66.--Survey Responses: “How effective do you feel Marine Preserve Areas (MPAs) have been in promoting sustainable nearshore fisheries in the Marianas?”

Percentage of Responses [n]	Extremely Effective (%)	Somewhat Effective (%)	Neutral (%)	Somewhat Ineffective (%)	Not Effective At All (%)
Full Sample [137]	25.6	35.0	21.1	9.5	8.8
<i>GFCA Membership</i>					
Yes [71]	21.1	33.8	21.1	12.7	11.3
No [66]	30.3	36.3	21.2	6.1	6.1
<i>Sell Fish</i>					
Yes [94]	22.3	35.1	21.3	11.7	9.6
Highliner [15]	13.3	33.4	20.0	13.3	20.0
Not highliner [79]	24.1	35.4	21.5	11.4	7.6
No [43]	32.6	34.9	20.9	4.7	6.9
<i>Primary Target</i>					
Pelagics [88]	26.1	31.8	22.7	11.4	7.9
Bottomfish [18]	16.7	44.4	22.2	11.1	5.6
Reef fish [10]	40.0	30.0	10.0	0.0	20.0
No primary [21]	23.8	42.9	19.0	4.8	9.5
<i>Boat Ownership</i>					
Yes [95]	25.3	30.5	23.2	11.6	9.4
No [42]	26.2	45.2	16.7	4.8	7.1

While a majority of fishermen agreed that the marine preserve areas have been at least somewhat effective in promoting sustainable nearshore fisheries, many do not agree with many aspects of their design, management, and enforcement. As shown in the comments in Appendix B, many fishermen insist that additional research is needed on the efficacy of existing MPAs.

Military Impacts

In early 2010, the U.S. military began exercises in an area south and southeast of Guam designated as W-517. This area is a special use airspace (SUA) of approximately 14,000 nm² that overlays deep open ocean approximately 50 miles south-southwest of Guam. Exercises in W-517 generally involve live fire and/or pyrotechnics. When W-517 is in use, a notice to mariners (NTM) is issued, and vessels attempting to use the area are advised to be cautious of objects in the water and other small vessels. This discourages access to virtually all banks south of Guam, including Galvez, Santa Rosa, White Tuna, and other popular fishing areas. From 1998 to 2009, DAWR surveys recorded more than 2020 trolling and bottomfish trips to these southern banks, an average of more than 72 trips per year. During 2011, 59 NTMs comprising a total of 112 days (30.7% of all days) were issued for area W-517. This makes access to these banks less attractive for nearly a third of the year. Additionally, the military occasionally holds exercises that do not involve live fire, but still restrict access to the area. As no notice is given for these events, there is not a reliable way to track how frequently this occurs (Tibbatts⁹; Tibbatts and Flores, 2012).

⁹ B. Tibbatts, Guam Division of Aquatic and Wildlife Resources, Pers. commun., 2012

Fishermen were asked to report on what percentage of their fishing trips, by trip type, in the past 12 months were affected by military exercises. A majority of fishermen (54%) reported that military exercises affected pelagic trips, while 42% reported affected bottomfish trips and 31% reported affected reef fishing trips. The average percentage of trips affected by military exercises, by trip type, across subgroups of the fishery is presented in Table 67.

Table 67.--Survey Responses: “In the past 12 months, what percent of your fishing trips were affected by military exercises?”

Percentage of Responses [n]	<i>Pelagics</i>			<i>Bottomfish</i>			<i>Reef Fish</i>		
	Mean	St. Error	Median	Mean	St. Error	Median	Mean	St. Error	Median
Full Sample [139]	16.8	2.2	5.0	13.6	2.2	0.0	9.5	1.9	0.0
<i>GFCMA Membership</i>									
Yes [74]	23.1	3.3	14.8	16.3	3.3	5.0	13.3	3.4	0.0
No [65]	9.6	2.6	0.0	10.8	2.8	0.0	5.3	1.9	0.0
<i>Sell Fish</i>									
Yes [96]	20.6	2.9	5.0	16.2	2.9	0.0	11.9	2.8	0.0
Highliner [15]	18.8	6.2	24.5	6.3	2.7	0.0	5.9	2.7	0.0
Not highliner [81]	20.9	3.2	5.0	18.0	3.3	0.0	13.1	3.3	0.0
No [43]	8.3	2.8	0.0	8.1	3.0	0.0	4.6	1.6	0.0
<i>Primary Target</i>									
Pelagic [90]	18.1	2.8	5.0	13.7	2.7	0.0	9.2	2.5	0.0
Bottomfish [18]	17.7	7.4	0.0	16.9	7.6	0.0	9.3	6.1	0.0
Reef fish [10]	7.4	5.3	0.0	5.4	3.6	0.0	7.2	4.8	0.0
No primary [21]	15.1	5.2	5.0	14.3	5.8	2.5	12.4	5.8	2.5
<i>Boat Ownership</i>									
Yes [95]	17.5	2.6	5.0	13.7	2.6	0.0	8.3	2.2	0.0
No [44]	15.2	3.9	0.0	13.5	4.1	0.0	12.0	4.1	0.0

While we did not explicitly ask fishermen how their trips were affected by military exercises, it is clear significant impacts could occur including economic impacts such as increased travel costs to launch a vessel, increased search costs associated with not fishing in familiar and productive fishing grounds, changing targeting methods to more fuel-intensive methods such as trolling...to not fishing at all, which may have important social and cultural impacts associated with it.

Comments from Fishermen

At the end of the survey, space was provided for additional comments regarding management and research suggestions. To the prompt “Do you have any suggestions for how the Marianas’ fisheries should be managed or topics that you feel need further study?”, approximately 24% of survey respondents provided feedback on a broad range of subjects. All comments can be found, loosely organized by subject, in Appendix B. Most commonly noted were a variety of opinions on how to better manage the fisheries and a number of comments and frustrations aimed at the current state of MPAs, FADs, and deteriorating fishing infrastructure. Fishermen expressed the desire for a community-based management system and for more fisheries-related educational programs for the public. Several suggestions were made for new regulations that would include fishing

licenses, size and bag limits for fish, restrictions on spearfishing with scuba gear, and restrictions on commercial fishing by longliners and purse seiners. Fishermen asked for better enforcement of the current MPAs and presented differing opinions regarding whether there should be more MPAs or none at all. Some fishermen asked for periodic opening of current MPAs and for better research on their affected fish stocks. Several commenters expressed the need for better fishing infrastructure – particularly for more boat ramps and vehicle and trailer parking. Lastly, several respondents noted that more FADs should be put out and that FADs should be replaced whenever they are lost.

CONCLUSION

Using results of a survey fielded in 2011, this paper has described current fishing activity, operational and behavioral aspects of Guam small boat fishing, and the levels of investment and economic expenditures associated with fishing on Guam. We detailed the important social and cultural linkages that the fishery provides, which undoubtedly has significant influence on the motivations and behavior of Guam fishermen and the broader community.

Based on the average catch disposition of Guam landings, it is clear that for nearly all fishery participants the social and cultural motivations for fishing far outweigh any economic prospects. In considering fishing profitability, we find that nearly all fishermen supplement their income with other jobs and are predominantly subsistence fishermen, selling occasionally to recover trip expenses. Using reported revenues we found that 64% of fishermen reporting the sale of fish earned fishing revenues of less than \$1000, which would not cover overall trip expenditures for the year. Additionally, we find that fish are an important source of food security for fishing families as 78% of survey respondents consider the pelagic fish they catch to be an important source of food for their family, with 79% and 85% affirming likewise for bottomfish and reef fish, respectively.

We find the Guam small boat fishery to be a complex mix of subsistence, cultural, recreational, and quasi-commercial fishermen whose fishing behaviors provide evidence of the importance of fishing to the island of Guam. This report provides important baseline information that can be used to inform future management alternatives and actions.

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http://www.pifsc.noaa.gov/wpacfin/guam/dawr/Pages/gdawr_data_menu.php

Western Pacific Fishery Information Network (WPacFIN).

2012. 1982-2011 Annual Trends in catch/effort by boat-based fishing method

http://www.pifsc.noaa.gov/wpacfin/guam/dawr/Pages/gdawr_data_1.php

APPENDIX A. SURVEY INSTRUMENT

OMB Control # 0648-0369

Expiration Date 02/28/2013

Hafa adai, help us to better understand the importance of fishing in the Mariana Archipelago. Your details of fishing experiences and expenditures are important for getting accurate results. We want to best represent Marianas fishermen and we can only do that by hearing from as many fishermen as possible. While your response is voluntary, we hope that you can help us in this research.

SECTION A. YOUR FISHING EXPERIENCES

Different fishermen in the Marianas had different fishing experiences over the past 12 months. Please tell us about yours.

1. Approximately how many boat fishing trips did you take over the past 12 months? (please check one)

- ☐ Fewer than 12 trips (about once every month or less)
- ☐ 12 – 24 trips (about once every other week)
- ☐ 25 – 49 trips (about once a week)
- ☐ 50 – 99 trips (about once or twice a week)
- ☐ 100 – 200 trips (about two to three times a week)
- ☐ more than 200 trips (about four times a week)

2. In the past 12 months, how many of your boat fishing trips were primarily: (please check one for each gear)

	Almost all of my trips (90%-100%)	Most of my trips (60%-89%)	About half (40%-59%)	Some of my trips (10%-39%)	Very few of my trips (1%-9%)	None of my trips
Trolling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deep Water Bottomfish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shallow Water Bottomfish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Atulai	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reef Fishing (Spear)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reef Fishing (Net)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify below)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. In the past 12 months, how many of your fishing trips were in

	Almost all of my trips (90%-100%)	Most of my trips (60%-89%)	About half (40%-59%)	Some of my trips (10%-39%)	Very few of my trips (1%-9%)	None of my trips
Local waters <u>only</u> (0-3nm)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Offshore waters <u>only</u> (greater than 3nm)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fished in both Local and Offshore waters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. In the past 12 months, how many of your fishing trips were:

	Almost all of my trips (90%-100%)	Most of my trips (60%-89%)	About half (40%-59%)	Some of my trips (10%-39%)	Very few of my trips (1%-9%)	None of my trips
Single day (or night) trips	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Multiday trips	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. How long is your average fishing trip? ____ hours

5a. How many hours are you actually fishing? ____ hours

6. How many people in total, including yourself, are on board for an average fishing trip? _____ people

7. Do you always fish out of the same boat ramp or harbor?

☐ YES

If you answered yes, go to Question 8

☐ NO

If no:

7a. On average, how many different boat ramps or harbors do you use in a year? _____ ramps

8. On average, how far (one-way) do you travel to fish? _____ miles

If trailered, indicate one-way distance to most common ramp; If moored, please indicate one-way distance to slip.

9. In the past 12 months, approximately how many total pounds of pelagic fish did **you** catch?

☐ None

☐ 101 – 250 pounds

☐ 1 – 50 pounds

☐ 251 – 500 pounds

☐ 51 – 100 pounds

☐ More than 500 pounds → About how much? _____ pounds

10. In the past 12 months, approximately how many total pounds of bottomfish did **you** catch?

☐ None

☐ 101 – 250 pounds

☐ 1 – 50 pounds

☐ 251 – 500 pounds

☐ 51 – 100 pounds

☐ More than 500 pounds → About how much? _____ pounds

11. In the past 12 months, approximately how many total pounds of reef fish did **you** catch?

- | | |
|---|--|
| <input type="checkbox"/> None | <input type="checkbox"/> 51 – 100 pounds |
| <input type="checkbox"/> 1 – 25 pounds | <input type="checkbox"/> 101 – 250 pounds |
| <input type="checkbox"/> 26 – 50 pounds | <input type="checkbox"/> More than 250 pounds → About how much? _____ pounds |

12. In the past 12 months, during which months did you fish for? (check all that apply)

- | <u>Pelagic Fish</u> | <u>Bottomfish</u> | <u>Reef Fish</u> |
|---|---|---|
| <input type="checkbox"/> Winter (December - February) | <input type="checkbox"/> Winter (December - February) | <input type="checkbox"/> Winter (December - February) |
| <input type="checkbox"/> Spring (March - May) | <input type="checkbox"/> Spring (March - May) | <input type="checkbox"/> Spring (March - May) |
| <input type="checkbox"/> Summer (June - August) | <input type="checkbox"/> Summer (June - August) | <input type="checkbox"/> Summer (June - August) |
| <input type="checkbox"/> Fall (September - November) | <input type="checkbox"/> Fall (September - November) | <input type="checkbox"/> Fall (September - November) |

13. In the past 12 months, how many of your fishing trips did you fish at Fish Aggregating Devices (FADs):

- | Almost all of
my trips
(90%-100%) | Most of
my trips
(60%-89%) | About
half
(40%-59%) | Some of
my trips
(10%-39%) | Very few
of my trips
(1%-9%) | None of
my trips |
|---|----------------------------------|----------------------------|----------------------------------|------------------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

SECTION B. MARKET PARTICIPATION

14. People have different opinions on the definition of commercial fishing. How would you define a fisherman as commercial? To be considered a commercial fisherman, I feel that someone must: (check all that apply)

- | | |
|--|--|
| <input type="checkbox"/> Sell at least one fish | <input type="checkbox"/> Make at least 25% of personal income from fishing |
| <input type="checkbox"/> Sell 25% or more of catch | <input type="checkbox"/> Make at least 50% of personal income from fishing |
| <input type="checkbox"/> Sell 50% or more of catch | <input type="checkbox"/> Make <u>all</u> personal income from fishing |
| <input type="checkbox"/> Sell <u>all</u> catch | <input type="checkbox"/> Other _____ |

15. How do you define yourself as a fisherman? (check all that apply)

- ☐ **Purely Recreational** (I fish only for sport or pleasure)
- ☐ **Recreational Expense** (I fish primarily for sport or pleasure, but I also sell a few fish to recover trip expenses)
- ☐ **Subsistence** (I fish primarily to catch fish to feed myself/my family)
- ☐ **Cultural** (I enjoy fishing, but I am even more concerned about keeping traditional practices alive, such as using traditional fishing gear and sharing fish with the community)
- ☐ **Part-time Commercial** (Fishing pays some of my bills, but I still have to work at another job)
- ☐ **Full-time Commercial** (Fishing brings in most or all of the money I make in a year)

16. In the past 12 months, what percentage of your catch was:

	Almost all of my fish (90%-100%)	Most of my fish (60%-89%)	About half (40%-59%)	Some of my fish (10%-39%)	Very little of my fish (1%-9%)	None of my fish	
Caught and released	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Consumed at home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Given to crew	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Given to family members	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Given to friends/neighbors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Caught for fiestas or other community/cultural events	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traded for goods and services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sold	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	→ If none sold, go to Question 23, page 5

If you sold any of your fish...

17. Where did you sell your catch?

	Almost all of my fish (90%-100%)	Most of my fish (60%-89%)	About half (40%-59%)	Some of my fish (10%-39%)	Very little of my fish (1%-9%)	None of my fish
Guam Fishermen's Coop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Roadside Dealer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Retail Markets/Stores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restaurants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Friends/Neighbors/Coworkers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wholesaler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you sold any of your fish...

18. In the past 12 months, after what percentage of your fishing trips did you sell a portion of your catch?

Almost all (90%-100%)	Most (60%-89%)	About half (40%-59%)	Some (10%-39%)	Very few (1%-9%)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you sold any of your fish...

19. Can you usually sell all of the fish that you want to sell?

Pelagic Fish

☐ Yes
☐ No
☐ I don't sell these fish

Bottomfish

☐ Yes
☐ No
☐ I don't sell these fish

Reef Fish

☐ Yes
☐ No
☐ I don't sell these fish

19a. If NO - why not?

If you sold any of your fish...

20. In the past 12 months, what was the approximate value of all the fish you sold?

<input type="checkbox"/> \$1 - \$100	<input type="checkbox"/> \$1,001 - \$5,000
<input type="checkbox"/> \$101 - \$500	<input type="checkbox"/> \$5,001 - \$10,000
<input type="checkbox"/> \$501 - \$1,000	<input type="checkbox"/> More than \$10,000 → About how much? \$ _____

If you sold any of your fish...

21. In the past 12 months what percent of your personal income came from the sale of fish?

<u>Almost all</u> (90%-100%)	<u>Most</u> (60%-89%)	<u>About half</u> (40%-59%)	<u>Some</u> (10%-39%)	<u>Very little</u> (1%-9%)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you sold any of your fish...

22. In the past 12 months, what percent of your fishing income came from the sale of:

	<u>Almost all</u> (90%-100%)	<u>Most</u> (60%-89%)	<u>About half</u> (40%-59%)	<u>Some</u> (10%-39%)	<u>Very little</u> (1%-9%)	<u>None</u>
Pelagic Fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bottomfish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reef Fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

23. Are the fish you catch an important source of food for your family?

Pelagic Fish

☐ Yes
☐ No
☐ I don't catch these fish

Bottomfish

☐ Yes
☐ No
☐ I don't catch these fish

Reef Fish

☐ Yes
☐ No
☐ I don't catch these fish

SECTION C. VESSEL AND GEAR

In this section we want to better understand the vessel and gear characteristics of Marianas' fishing

24. Do you own the boat that you fish on?

☐ YES → If yes, go to Question 25 on page 7

☐ NO

24a. Do you always fish on the same boat?

☐ YES

☐ NO

24b. Do you always fish with the same captain?

☐ YES

☐ NO

24c. Are you compensated for your time as crew? (if yes, check box and estimate percentage (%), check all that apply)

☐ YES

☐ NO → If no, go to Question 36 on page 8

☐ I keep a percentage of total fish caught _____ % of fish caught

☐ I get a percentage of the value of the fish sold _____ % of value for trip

☐ I pay a percentage of trips costs _____ % of trip costs

☐ I keep all the fish I catch

☐ Don't know/different every time

If you have some other compensation arrangement that you could detail, please describe below:

Please continue to
Question 36 on page 8 →

If you own the boat you fish on:

25. What is the length of your boat? _____ feet

26. What is the horsepower? _____ hp

27. In what year was the boat built? _____

28. Do other people use the boat without you?

Often

☐

Sometimes

☐

Rarely

☐

Never

☐

29. When you are the boat captain, how do you typically compensate your crew?

☐ Given a percentage of total fish caught _____ %

☐ Given a percentage of value of fish sold _____ %

☐ Crew pays a percentage of trips costs _____ %

☐ Crew keeps all the fish they catch

☐ I always fish alone

☐ Don't Know/different every time

If you have some other compensation arrangement that you could detail please describe below:

30. In what year did you purchase the boat you fish on? _____

(if homebuilt – when did you complete it?)

31. How much did you pay to purchase the boat you fish on? \$ _____

(if homebuilt – how much did it cost to build it?)

32. Was the boat purchased...

☐ New

☐ Used

33. How did you purchase this boat?

☐ cash only

☐ cash and loan _____

☐ loan only _____

If cash and loan or loan only:

33a. What was the original loan amount? \$ _____

34. What is the approximate market value, in dollars (considering age and current condition), of the **electronics** you currently use to fish? \$ _____

35. When did you last upgrade your fishing electronics (GPS, fishfinder/recorder)?

this past year

☐

1 to 3 years ago

☐

over 3 years ago

☐

36. What is the approximate market value, in dollars (considering age and current condition), of the **gear** you currently use to fish (not including electronics)? \$ _____

If you own the boat you fish on:

37. What is the approximate market value, in dollars (considering age and current condition), of your **boat** (including motor(s) and trailer, but not including gear, equipment, or electronics mentioned above)? \$ _____

SECTION D. YOUR LAST FISHING TRIP

We'd like to know how much it cost for your most recent fishing trip

38. Think about your last boat fishing trip, in what month and year was this trip made? _____ month
 _____ year

39. What was the primary gear type for this trip

- | | | |
|---|--|---|
| <input type="checkbox"/> Trolling | <input type="checkbox"/> Atulai | <input type="checkbox"/> Reef fishing with nets |
| <input type="checkbox"/> Deep water bottomfish | <input type="checkbox"/> Spear fishing | <input type="checkbox"/> Other _____ |
| <input type="checkbox"/> Shallow water bottomfish | <input type="checkbox"/> Scuba spear | |

40. How much money was spent on your most recent fishing trip?

Type of Expenditure	Trip Expenditure (most recent trip)	What type of fuel?
Boat fuel	\$ _____	<input type="checkbox"/> gas <input type="checkbox"/> diesel
Truck fuel (round-trip)	\$ _____	<input type="checkbox"/> gas <input type="checkbox"/> diesel
Ice	\$ _____	
Bait	\$ _____	
Food and beverage	\$ _____	
Other (specify) _____	\$ _____	

40a. What percentage of these costs did you pay? _____ %

41. What is your second most common gear usage (please check one)

- | | | |
|---|--|---|
| <input type="checkbox"/> Trolling | <input type="checkbox"/> Atulai | <input type="checkbox"/> Reef fishing with nets |
| <input type="checkbox"/> Deep water bottomfish | <input type="checkbox"/> Spear fishing | <input type="checkbox"/> Other _____ |
| <input type="checkbox"/> Shallow water bottomfish | <input type="checkbox"/> Scuba spear | |

42. On average how much money do you spend on second most common (question 41) fishing trips?

Type of Expenditure	Trip Expenditure (most recent trip)	What type of fuel?
Boat fuel	\$ _____	<input type="checkbox"/> gas <input type="checkbox"/> diesel
Truck fuel (round-trip)	\$ _____	<input type="checkbox"/> gas <input type="checkbox"/> diesel
Ice	\$ _____	
Bait	\$ _____	
Food and beverage	\$ _____	
Other (specify) _____	\$ _____	

42a. What percentage of these costs did you pay? _____ %

SECTION E. 2010 FISHING EXPENDITURES

In an effort to better understand your economic contribution to the Marianas' economy we would like to ask about your fishing-related expenditures in 2010. In the table below please indicate how much, if any, was spent on the following items during 2010.

*Enter "0" if you did not have any expenses in a category. Please do not leave blank.
Remember that all your answers are strictly confidential.*

43.

Cost Category	2010 Expenditure (dollars)
Boat insurance	\$ _____
Loan payments	\$ _____
Financial services (accounting, taxes)	\$ _____
Moorage fees	\$ _____
Repair, maintenance, and improvements for vessel, engines, or trailer	\$ _____
Oil and lube	\$ _____
Gear (lines, lures, gaffs, rods, electric/hydraulic reels, spears, wetsuits, coolers, etc.)	\$ _____
Electronics	\$ _____
Fees (Registration for truck and trailer, dry dock fees, fishing club dues, Coop fees, etc.)	\$ _____
Safety Equipment	\$ _____
Other (specify) _____	\$ _____

44. Some fishermen purchase fishing gear, electronics, safety equipment or other items off-island, online, or through a catalog. Approximately what percentage of these expenditures were purchased off-island?
_____ %

SECTION F. ABOUT YOU

*Different people have different fishing experiences and different motivations for fishing.
The following questions help us to better understand these differences.*

45. What is your age?

- | | |
|---|---|
| <input type="checkbox"/> Less than 25 years | <input type="checkbox"/> 45 to 54 years |
| <input type="checkbox"/> 25 to 34 years | <input type="checkbox"/> 55 to 64 years |
| <input type="checkbox"/> 35 to 44 years | <input type="checkbox"/> more than 64 years |

46. What village do you live in? _____

47. How long have you lived in the Marianas? _____ years

48. How long have you fished from a boat? _____ years

49. Are you of a member of a fishing club/association/group? (please check all that apply)

- | | |
|--|--|
| <input type="checkbox"/> Guam Fishermen's Cooperative Association (GFCA) | <input type="checkbox"/> Marianas Underwater Fishing Federation (MUFF) |
| <input type="checkbox"/> Guam Organization of Saltwater Anglers (GOSA) | <input type="checkbox"/> Saipan Fishermen Association (SFA) |
| <input type="checkbox"/> Marianas Apnea Spearfishing Club (MASC) | <input type="checkbox"/> Halum Mamati Fishing Club (HMFC) |
| <input type="checkbox"/> Other (please specify) _____ | <input type="checkbox"/> None |

50. Are you of Hispanic, Latin, or Spanish Origin?

- | | | |
|--|---|-------------------------------------|
| <input type="checkbox"/> No | <input type="checkbox"/> Yes, Mexican, Mexican American, Chicano | <input type="checkbox"/> Yes, Cuban |
| <input type="checkbox"/> Yes, Puerto Rican | <input type="checkbox"/> Yes, another Hispanic, Latino, or Spanish Origin _____ | |

51. How would you describe your race? (check all that apply)

- | | |
|--|--|
| <input type="checkbox"/> Guamanian or Chamorro | <input type="checkbox"/> Carolinian |
| <input type="checkbox"/> Filipino | <input type="checkbox"/> Native Hawaiian |
| <input type="checkbox"/> White | <input type="checkbox"/> Samoan |
| <input type="checkbox"/> Chinese | <input type="checkbox"/> Other Pacific Islander (please specify) _____ |
| <input type="checkbox"/> Japanese | <input type="checkbox"/> Asian Indian |
| <input type="checkbox"/> Korean | <input type="checkbox"/> American Indian or Alaska Native |
| <input type="checkbox"/> Vietnamese | <input type="checkbox"/> Black, African American, or Negro |

52. Are you currently employed?

- | | |
|--|--|
| <input type="checkbox"/> Employed full-time | <input type="checkbox"/> Student (part-time) |
| <input type="checkbox"/> Employed part-time | <input type="checkbox"/> Unemployed |
| <input type="checkbox"/> Retired | <input type="checkbox"/> Other (specify) _____ |
| <input type="checkbox"/> Student (full-time) | |

53. How many hours per week do you work for pay? _____ hours

54. What is the highest level of education you have completed?

- | | |
|---|---|
| <input type="checkbox"/> Less than 9 th grade | <input type="checkbox"/> Associates degree or technical school |
| <input type="checkbox"/> Some high school (no diploma) | <input type="checkbox"/> College graduate (bachelor degree) |
| <input type="checkbox"/> High school graduate (including GED) | <input type="checkbox"/> Advanced, professional, or doctoral degree |
| <input type="checkbox"/> Some college (no degree) | |

55. What was your total household income, before taxes, in 2010, including fishing income?

- | | |
|---|---|
| <input type="checkbox"/> Less than \$10,000 | <input type="checkbox"/> \$50,000 to \$74,999 |
| <input type="checkbox"/> \$10,000 to \$14,999 | <input type="checkbox"/> \$75,000 to \$99,999 |
| <input type="checkbox"/> \$15,000 to \$24,999 | <input type="checkbox"/> \$100,000 to \$149,999 |
| <input type="checkbox"/> \$25,000 to \$34,999 | <input type="checkbox"/> \$150,000 to \$199,999 |
| <input type="checkbox"/> \$35,000 to \$49,999 | <input type="checkbox"/> \$200,000 or more |

SECTION G. WHAT DO YOU THINK?

56. In the next year do you think more people will be involved in...(please check one for each)

- | <u>Pelagic Fishing</u> | <u>Bottomfish Fishing</u> | <u>Reef Fishing</u> |
|------------------------------|------------------------------|------------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> Yes | <input type="checkbox"/> Yes |
| <input type="checkbox"/> No | <input type="checkbox"/> No | <input type="checkbox"/> No |

56a. Why do you feel this way?

57. In the last five (5) years, do you believe it has become...(please check one for each)

- | <u>Pelagic Fish</u> | <u>Bottomfish</u> | <u>Reef Fish</u> |
|---|---|--|
| <input type="checkbox"/> Easier to catch pelagic fish | <input type="checkbox"/> Easier to catch bottomfish | <input type="checkbox"/> Easier to catch reef fish |
| <input type="checkbox"/> Harder to catch pelagic fish | <input type="checkbox"/> Harder to catch bottomfish | <input type="checkbox"/> Harder to catch reef fish |
| <input type="checkbox"/> About the same | <input type="checkbox"/> About the same | <input type="checkbox"/> About the same |
| <input type="checkbox"/> I don't target these fish | <input type="checkbox"/> I don't target these fish | <input type="checkbox"/> I don't target these fish |

57a. What has made it easier or harder to catch fish?

58. As a fisherman I am respected by the community

- | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------------------|
| Strongly Agree | Somewhat Agree | Neutral | Somewhat Disagree | Strongly Disagree | <input type="checkbox"/> Don't Know |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |

59. How familiar are you with the Marianas Trench Marine National Monument?

- ☐ Extremely familiar (I know what it is and where it's located)
- ☐ Somewhat familiar (I have heard of it but I don't know many details about it)
- ☐ I have not heard of it

60. Do you feel the Marianas Trench Marine National Monument will benefit the local economy?

- ☐ Yes
- ☐ No
- ☐ Don't Know

61. Do you feel the Marianas Trench Marine National Monument will help to increase your catch rates?

- ☐ Yes
☐ No
☐ Don't Know

62. How effective do you feel Marine Protected Areas (MPAs) have been in promoting sustainable nearshore fisheries in the Marianas

Extremely Effective Somewhat Effective Neutral Somewhat Ineffective Not Effective
☐ ☐ ☐ ☐ ☐

63. In the past 12 months, what percentage of your fishing trips did you have interactions with sharks?

	Almost all (90%-100%)	Most (60%-89%)	About half (40%-59%)	Some (10%-39%)	Very little (1%-9%)	None
Pelagic Fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bottomfish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reef Fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

64. In the past 12 months, what percentage of your fishing trips were affected by military exercises?

	Almost all (90%-100%)	Most (60%-89%)	About half (40%-59%)	Some (10%-39%)	Very little (1%-9%)	None
Pelagic Fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bottomfish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reef Fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Thank you for participating in this survey.

Please go to next page to provide additional comments →

**Do you have any suggestions for how the Marianas' fisheries should be managed or topics that you feel need further study?
 (please write in the space provided)**

Would you like to receive a copy of the final report for this study?
 (all personal information will be kept strictly confidential)

- ☐ YES
☐ NO

Name:

Address:

May we contact you if we have any questions about your survey responses?

- ☐ YES Phone: _____ best time to reach you: _____
☐ NO (your phone number will be kept strictly confidential)

Paperwork Reduction Act Statement. The information you provide will remain strictly confidential as required by section 402(b) of the Magnuson-Stevens and NOAA Administrative Order 216-100, Confidentiality of Fisheries Statistics, and will not be released for public use except in aggregate statistical form without identification as to its source. We will combine your responses with information provided by other participants, and report it in summary form so that responses for any individual vessel can not be identified. Public reporting burden for this information collection, including time for gathering data needed and completing the survey, is estimated to average 45 minutes per respondent. Please provide comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Justin Hospital, NOAA Fisheries, 1601 Kapiolani Blvd, Suite 1110, Honolulu, HI 96814, 808-944-2188, Justin.Hospital@noaa.gov. Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.

APPENDIX B. COMMENTS FROM FISHERMEN

This appendix presents all comments provided by survey respondents when asked for suggestions for how Guam's fisheries should be managed or topics needing further study. The comments have been organized by broad topic areas and the number of comments relating to each topic is noted in parentheses (number of comments). Some comments were split for organizational purposes; however, comments were not edited for content, and no individual comment is repeated.

General Suggestions and Comments: (7)

- Less federal and local restrictions.
- It would be good to follow the Belau seasons for certain fish catches...
- To please keep the "sustenance fisherman" in consideration. Although tourism makes up 90% of Guam's income, fishing has always been an integral part of the island culture and a simple but efficient way for people with limited income [cannot read] to the people with limited income [cannot read] to the people who have too much pride to ask for government handouts to [cannot read].
- There is a high percentage of sharks on the Southern Banks. How will the dredging of the harbor affect the fish population? Is there an alternative site for the military to perform their target practice?
- Is restocking of fisheries feasible?
- ... Have more awareness of impacts on the ocean. And continue perpetuating the local fishing programs, events, awareness, and traditions...
- I have scuba dove Guam for the last four years. I do not use scuba to catch fish, but have noticed the reefs' declining health. Why is everyone on this island allowed to dump trash/chemical and raw sewage into the ocean? The people on this island are poisoning the ocean and killing the reef. Beautiful beaches but I cannot swim in the ocean? More trash, dead ocean, poisoned fish, greedy shop keepers, and you wonder why tourism is down. Gee, maybe they went to Hawaii?

Public Engagement and Education: (3)

- International fish market fair market value of fish caught. Education to enhance.
- ... More info for the public about what size fish help with reproducing. How nets affect the reef fish.
- ...Have more awareness programs on fisheries...

Community-Based Management: (3)

- ...Establish a community based fisheries program. Community driven programs...
- ... Too many special interests telling us what to do. Community based management.
- This is a good start - get local input for our very small fishery. We do not make as big an impact as Hawaii and the mainland.

Fishing Funds: (3)

- ...Have the local government provide an annual appropriation to GFCA, 100 K managed by the GFCA Board...
- I believe the current practice of no local fishing funds leads to disinterest in government of Guam participation in important fishing matters...
- I would like to see sport fishing funds spent more efficiently...

Current Regulations and Enforcement: (2)

- ...Enforce existing rules and regulations.
- Repeal the shark ban...

MPAs: (7)

- ...Re-evaluate current laws, i.e. MPA, and introduce amendments, additions, or repeals...
- More MPA's...
- ... With the Marine Preserves in effect there is too much fishing concentrated in non-preserve areas. Biologists need to swim the reefs everyday to have more accurate fish count. There is a lot they do not see. The dead fish data collected is extremely flawed. Because there are many factors that influence the fisherman's catch.
- Open preservation sites and close out new reefs that are in need of it...
- ... Open the marine preserves to periodic fishing (once or twice a year), year around catch and release, tagging, and require a license to do these activities.
- Agriculture, Fish, and Wildlife must enforce fishing in the preserves. Micronesians and some locals (Chamorros) alike fish in the preserves. PRESERVES ARE USELESS IF THEY ARE FISHED BECAUSE OF NO ENFORCEMENTS OF LOCAL LAWS. These fish are sold in local markets on a daily basis.
- ...Just allow us to fish with no restrictions. No preserves...

Suggested Regulations: (6)

- 1.) Institute a Fisheries Act for Guam. 2.) Establish a Fisheries Registry. 3.) Establish fishing permits...
- Need to look into bag/size limits on reef fish...
- I think we need to manage the outside (non-Chamorro) fishermen through licensing...
- Regulate fishing (seasonal).
- Annual fish licensing. Fish bag and size limits. See Department of Natural Resources.
- Boat gas reimbursement. Safety equipment donations...

Commercial Fishing: (3)

- ... Restrict commercial harvest of tuna on high seas.
- ... Ban Purse seine

- ... I also think the current practice of allowing dumping of foreign longline fish on local market artificially depresses market price.

Scuba Spear: (2)

- ...Outlaw scuba spear at night.
- ...Completely BAN!! scuba diving (night time spearfishing). "Not considered fishing at all to my eyes, more of harvesting than it is fishing!!" Enforce tag and release practices for commercial fishing.

Infrastructure: (4)

- They need to build a boat ramp on east side of island. 75% of Guam coastline has no place to launch boat.
- ... Rebuild both Hagatna and Agat docks and ramps.
- 1.) Build another boat ramp. 2.) Upgrade bathroom facilities and keep open 24 hours. 3.) Have trash bin available at all times. 4.) Parking for vehicle/trailer. 5.) Ice shop open at early morning.
- 1.) Boat trailer parking at Hagatna and Agat marinas are lacking or not accessible. 2.) No restrooms at marinas.

FADs: (4)

- ... Better manage the FADs and fishing infrastructure (docks, FADs, etc.).
- ...Once a FAD breaks off, it should be immediately replaced. All F.A.D.'s should always be out! The money is there.
- More FADs.
- ...DAWR: Keep the FADs in place. Quit working against the fishermen.

Research: (4)

- ...Control the science people on the research/study. Need to challenge their studies, results...
- Send better prepared people to do studies. Involve more fishermen for info (shark count).
Take more time - go more in depth when looking for info about fish in general.
So another survey on the presence of sharks.
- Study on purse seine and long line fishing on regional fish.
- Maybe a survey of how many people known someone that has fished in the preserves...

Miscellaneous: (3)

- Thank you! A great survey and hope it will help us fishermen in the future.
- 1.) Long line fisheries 2.) MPA 3.) Military interference
- Individual stewardship would go a long way. We need to ensure the fish stocks stay healthy.